A Comparative Analysis of

Health-Seeking Behaviors for

Women at Risk of Primary or Secondary Infertility

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved July 2012 by the
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ARIZONA STATE UNIVERSITY

August 2012

ABSTRACT

Health-seeking behaviors are influenced by multiple factors including an assessment of the symptoms, what degree of personal commitment is involved in treatment, and what, if any, alternative methods of treatment are available. In the case of infertility, seeking treatment is likely to occur after the inability to get pregnant or carry a pregnancy to term persists for longer then a year or more. This is after prolonged exposure to the risk of pregnancy fails to provide a successful pregnancy, and the desire for children remains. Most research on health-seeking behaviors for infertility focus on the nulliparous woman who is at risk of primary infertility. This research furthers this examination by comparing the rates of health-seeking behaviors for women at risk of primary infertility to women at risk of secondary infertility. A woman at risk of primary infertility is identified as nulliparous in that she has never been pregnant, or has never had a pregnancy end in live birth. A woman at risk of secondary infertility is identified as parous and has already had one pregnancy end in live birth. Using three pathways that include social factors, biological mechanisms, and contextual effects, I hypothesize that the rates of health-seeking behaviors will vary by infertility risk and that women at risk of primary infertility will have higher rates of health-seeking behaviors for infertility. These hypotheses are based on the Behavioral Model of Health Services Utilization and the Health Belief Model that states health-seeking behaviors are influenced by the presence of enabling and predisposing factors, combined with internal and external cues. Findings from this

dissertation suggest that the rates of health-seeking behaviors do indeed vary by infertility risk.

DEDICATION

Because you gave unconditional support, always had a good sense of humor, and said with sincerity “of course”, I dedicate this dissertation to you, Joe Weller. I said you.

ACKNOWLEDGMENTS

I would like to thank my committee chair, Scott Yabiku, and my committee members, Sarah Hayford and Jennie Kronenfeld who offered their expert guidance, support, and encouragement during this entire process. I especially thank Scott Yabiku for his patience, enthusiasm, and honesty throughout my graduate career, and for teaching me the value of writing a dissertation. I thank my parents for providing a lifetime of support and encouragement and for starting me on this journey, and to Abram and Helayna for being the reasons why I finished.

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Chapter 1

INTRODUCTION

This dissertation is a comparative analysis of three unique pathways that influence the risk of health-seeking behaviors (HSB) for infertility. The three pathways are social factors, biological mechanisms, and contextual effects. Selected social factors in this research include educational attainment, employment status, and relationship status. Maternal age and reproductive health histories are the included biological mechanisms, and state-level insurance mandates covering infertility services are the contextual effects.

The comparative analysis in this dissertation is an examination of how in the presence of these selected social factors, biological mechanisms, or contextual effects, the rates of HSB for infertility vary by parity status, or rather, there will be observable differences in the effects of these pathways on the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. Infertility, briefly defined, is the inability to get pregnant or carry a pregnancy to term. A respondent at risk of primary infertility is identified as nulliparous in that she has never been pregnant, or, has never had a pregnancy end in a live birth. A respondent at risk of secondary infertility, identified as parous, is a woman who has already had one pregnancy end in live childbirth but has been unable to subsequently get pregnant or carry a pregnancy to term.

In this dissertation I include two broad theories of HSB that have been previously identified as models to predicting HSB for general health conditions (i.e. heart disease, diabetes, or cancer). The first theory is the Behavioral Model of Health Services Utilization that states predisposing factors like age, education, and employment, and enabling resources like relationship status and contextual effects are useful tools in predicting HSB for general health conditions (Bradley *et al,* 2002; Andersen, 1995; Andersen 1968). In this dissertation I identify predisposing factors and enabling resources within each of three pathways and propose that in the presence of these selected measures the rates of HSB for infertility will increase, but more specifically, that the higher or lower rates of HSB will be dependent on parity status.

The second theory I incorporate in this dissertation is the Health Belief Model which states individuals will engage in both preventative and treatment-seeking health behaviors based on internal perceptions of susceptibility to an undesirable health outcome as well as external reinforcement that seeking treatment is an appropriate resolution (Stretcher & Rosenstock, 1997; Janz & Becker, 1984; Becker, 1974). For my research, I propose that internal cues like a previous diagnosis of a sexually-transmitted infection (STI) and external cues like state-level insurance mandates will increase the rates of HSB for infertility, and that the rates of HSB will be higher or lower dependent of parity status.

The overarching contribution of this dissertation is the comparative analysis of the rates of HSB by parity status. Other studies have considered the sociodemographic disparities in regards to who reports any lifetime infertility and who actually seeks out treatment. In these previous studies, the focus, for example, is on differences in HSB dependent on race/ethnicity or socioeconomic status. To my knowledge, no other study has examined the effects of social factors, biological mechanisms, or contextual effects on the rates of HSB for infertility through a comparative analysis that directly compares rates of HSB for women at risk of primary infertility to women at risk of secondary infertility.

It is important to compare the rates of HSB by parity status for many reasons. First, is because of the assumed higher rates of both reported and unreported, secondary infertility in the United States (Simmons, 2000). In addition, not all women who experience any lifetime infertility will seek treatment, so, not only is it important to identify what factors influence the decisions to engage in HSB, but to further this understanding and determine why women at risk of primary infertility behave differently compared to women at risk of secondary infertility. This distinction is essential in providing quality health and professional services for all women experiencing infertility.

Furthermore, it is important to examine the differences in HSB by parity status due in part to competing realities of changing social trends and norms that influence the timing and circumstances of childbearing, with the consistent fertility expectations that women will have two, or at least one, children during their reproductive life course (McQuillan, Greil, Shreffler, & Tichenor, 2008). Therefore, examining the effects of these competing realities on HSB by parity status is necessary to better understand the fertility outcomes and the infertility experience of women in the U.S.

The second reason is that the infertility experience for the nulliparous and parous woman is very different, and this difference has yet to be fully explored in the reproductive health research. Women experiencing secondary infertility, or parous respondents, present a unique infertility experience. On one hand, they are not necessarily infertile, because they have had at least one biological child; however, they are not necessarily fertile, because they are unable to have another biological child. The dual status of fertile/yet infertile distinguishes the parous woman from the nulliparous woman not only in how they identify and measure their infertility status, but in how, and why they engage in HSB for infertility. This dissertation would be the first study to examine how in the presence of select social factors, biological mechanisms, and contextual effects the rates of HSB for infertility will be higher or lower dependent on parity status.

The third and final reason is based on the assumption that the combined reported and unreported rates of secondary infertility are higher than the rates of primary infertility (Davis III, Hall, & Kaufmann, 2007; Bower, 2005; Simons, 2000). However, the general public perception of the infertile individual is that of the nulliparous woman - the woman at risk of primary infertility. Because of this perception much of the social, medical, and public health resources or information regarding infertility are geared towards the primary infertile woman, which subsequently fails to address the needs of the secondary infertile woman. By distinguishing between the two types of infertility risks, this dissertation proposes that there are indeed significant differences in HSB for infertility by parity status and that in the presence of the three unique pathways, there rates of HSB will be observably higher for women at risk or primary infertility.

In the chapters that follow, I define infertility for the purpose of this research, and present the theoretical reasoning, methodological construction, and substantive findings that compare the rates of HSB for women at risk of primary infertility to women at risk of secondary infertility. A brief description and summary of each chapter is presented here, beginning with Chapter Two. In this chapter I outline the various mechanisms in which infertility is defined and measured. This includes a biomedical definition of infertility that states couples are infertile if, after 12 months of consistent exposure to pregnancy, they are unable to get pregnant. A demographic approach to defining infertility is also considered which takes into consideration fertility intentions. Lastly, Chapter Two identifies the factors used to define and measure primary infertility versus secondary infertility. For the purpose of this dissertation, infertility for nulliparous or parous women is defined as the inability to get pregnant, and/or the inability to carry a pregnancy to term. In this last characterization, the inability to carry a pregnancy to term includes women who were able to get pregnant, but the pregnancy did not end in a live birth.

Chapter Three presents the theoretical framework by proposing two broad models of health-seeking behaviors for infertility. The first model is the Behavioral Model of Health Services Utilization which identifies predisposing factors, enabling resources, and internal and external factors that influence HSB

(Bradley *et al*, 2002; Andersen, 1995; Andersen 1968). The second model is the Health Belief Model which outlines a four-step process where individuals gauge various internal and external cues that influence the decision to engage in HSB (Stretcher & Rosenstock, 1997; Janz & Becker, 1984; Becker, 1974).

Within Chapter Three I propose the specific hypotheses for the effects of social factors, biological mechanisms, and contextual effects on the rates of HSB. Selected social factors include educational attainment, employment status, and relationship status. Selected biological mechanisms include maternal age and a lifetime diagnosis of various sexually transmitted infections (STI). Finally, selected contextual effects include state-level mandates that insurance programs either provide coverage for infertility services, or offer an option to include coverage in insurance plans for infertility services. For each measure of the social factors, biological mechanisms, and contextual effects I provide specific hypotheses that compare the rates of HSB by parity status. The overarching hypotheses for the dissertation is that in the presence of any of the social factors, biological mechanisms, or contextual effects, the rates of HSB for women at risk of primary infertility will be higher than the rates of HSB for women at risk of secondary infertility.

Chapter Four introduces the data and methodology for each of the three substantive research topics. The data comes from the National Survey of Family Growth (NSFG), 2006-2010 data file. I utilize four distinct data files in the analyses which include the female respondent file, the pregnancy file, the contextual data file, and the audio computer-assisted self-interviewing data file. The data files are merged together using the respondent case-identifier number. With the exception of the logistic regression analysis to test the effects of any lifetime STI on the odds of HSB, event-history discrete-time analyses are used to measure the rates of HSB by parity status. I make certain that the time-varying variables included in the event-history analyses are properly time-ordered in relation to the outcome variables.

Chapter Five presents the first substantive analyses for the social factors that include testing the effects of educational attainment, employment status, cumulative years of employment, and relationship type and relationship duration on HSB for infertility. I include these social factors in the analyses for three reasons. First is that these factors are associated with HSB for general health conditions, which I propose are applicable in measuring HSB for infertility. Second, these factors are associated with influencing fertility decisions in general, and testing their effects on infertility outcomes is appropriate. Finally, information about these social factors is collected retrospectively by the NSFG and is presented with start and end dates, making an event-history analysis an appropriate methodological procedure. Findings of note regarding significant differences in the rates of HSB by parity status are observed in the presence of the cumulative number of years of employment. With more years of employment, the rates of HSB are significantly higher for women at risk of secondary infertility compared to the rates of HSB for women at risk of primary infertility.

Chapter Six presents the second substantive analyses for the biological mechanisms which include event-history analyses testing the effects of maternal age on rates of HSB by parity status, and a logistic regression testing the effects of any lifetime diagnosis of a STI on the odds of HSB, by parity status. Significant differences in the rates of HSB by parity status are observed among women ages 25 to 39. More specifically, the rates of HSB for women at risk of primary infertility are significantly higher than the rates of HSB for women at risk of secondary infertility, among this age range. These significant differences are expected as the prime reproductive years for childbearing are represented among ages 25 to 39. The significant difference by parity status suggests that in addition to the predisposing factors of maternal age that predict HSB for infertility, parity status is also a significant predictor. More specifically, nulliparous women at risk of primary infertility between ages 25 to 39 have higher risks of HSB for infertility. Findings from the logistic regression testing any lifetime diagnosis of a series of five different STI on the odds of HSB suggest that in the presence of an STI diagnosis, the odds of HSB for infertility increase and that there are significant differences in odds of HSB by parity status. Although these findings are significant, it is important to note that the time-ordering of the STI diagnosis and date of any HSB for infertility is unknown; therefore, the logistic regression results provide a preliminary understanding of the links between sexual health and infertility HSB outcomes.

Chapter Seven presents the third and final substantive analyses measuring the effects of state-level mandates that insurance cover infertility services, or offer to provide an additional plan that would cover infertility services. In these analyses I look at the effects of state mandates under two circumstances. In the first, I test the effects of state mandates on a sample of women who reported living in the same state since the year 2000 until the time of their NSFG survey interview (from 2006 to 2010). For these women, I make two assumptions. The first assumption is if they have lived in the same state since 2000 (up until the end of the NSFG interview period) then they have lived in the same state since birth. In the second, I concede that even though the respondent has lived in the same state since 2000, it is possible they have lived in different states since birth. Therefore, my second assumption is any other states the respondent has lived in since birth, will have similar political, economic, and social policy characteristics. Therefore, under these two assumptions, I propose that living in states with insurance mandates will increase the rates of HSB for infertility. The findings from these analyses suggest that for women at risk of primary infertility, residing in states with mandates does increase the rates of HSB. There are no significant findings for women at risk of secondary infertility, nor are there are observed differences by parity status.

In the second circumstance, I remove any assumptions of place of residence since birth and only look at the rates of HSB that have occurred since 2000. Because approximately half (54%) of the HSB events for infertility occurred prior to 1999 and just less than half (46%) of HSB events occurred after 2000, testing the effects of state mandates in this manner is acceptable in light of the data restrictions, although not ideal. Findings from these analyses demonstrate that for women at risk of primary infertility, the rates of HSB increase if they reside in states with insurance mandates. There are no significant findings for women at risk of secondary infertility, nor are there any significant differences by parity status.

Chapter Eight summarizes the findings for each of the three substantive research chapters, discusses the implications of the findings, limitations of the research, and future research plan. An overall concluding discussion for this dissertation is provided which summaries the overall findings and implications of this research. In the proceeding chapter, I introduce competing approaches to defining and measuring infertility and present the working definition of infertility for this dissertation.

Chapter 2

INFERTILITY DEFINED

Infertility in the United States is quite common. According to the National Survey of Family Growth (NSFG) and the National Survey of Fertility Barriers (NSFB) over 7 million men and women of reproductive age, at least 51.3% of women aged 25-45, have experienced infertility at some point in their lives (Greil, McQuillan, & Slauson-Blevins, 2011; Chandra & Stephen, 2010). Studying the changing trends of infertility is important for multiple reasons that include providing insight into the social construction of health and illness as well as providing insight into the sociocultural disparities that exist in the American health care system. An additional aspect of infertility that is relevant to sociological studies on health outcomes is the idea that with increasing public knowledge about infertility and treatment options, there will be an increase in the number of individuals that seek advice and treatment for infertility. This in turn influences the number of physicians and health care providers that provide these services as well as influencing how health-care insurance programs provide coverage for these types of services.

The purpose of this dissertation is to look beyond the definition and measurement of infertility and to focus on comparing health-seeking behaviors among two groups of women: those at risk for primary infertility compared to those at risk for secondary infertility. However, defining infertility and establishing a background on how infertility is measured is necessary prior to testing the effects of social factors, biological mechanisms, and contextual effects on the rates of HSB for infertility. In this chapter I outline possible explanations for the increasing rates of infertility in the U.S., I compare the biomedical approach to a demographic approach of defining infertility, I discuss the conceptualization of infertility based on fertility intentions, I outline how primary and secondary infertility differ, and finally, I identify the definition of infertility that will be applied throughout this dissertation.

Infertility Defined: Rates and Trends

Since the 1980's the number of women reporting any lifetime infertility has slowly increased (Guzick & Swan, 2006; Chandra & Stephen, 2010). Some possible explanations for this increase have included an increased proportion of older, nulliparous women that are trying to have children at an advanced, and less fertile, maternal age, the increasing public awareness of infertility attributed in part to the medicalization of reproductive health and fertility treatments, and the asymptomatic or unrecognizable nature of STI that can cause fertility complications (Chandra & Stephen, 2010). However, some studies would suggest that the rates of lifetime infertility are actually higher than reported because women may not self-identify as infertile throughout their lifetime, or some women may not follow a medically defined measure of infertility which requires tracking regular, unprotected intercourse over a 12 month timeframe. Future projections of infertility rates suggest that the overall number of women experiencing any lifetime infertility is likely to continue growing as sociocultural factors contribute to delayed childbearing, advancements in reproductive technologies improve fertility outcomes, and changing insurance mandates give broader access to infertility treatments (Chandra & Stephen, 2010). To truly understand what these estimates mean for the prevalence of infertility in the United States, it is necessary to dissect the processes by which infertility is defined and measured.

Infertility Defined: Biomedical Approach

Most often infertility is defined within a biomedical context as the inability to conceive after 12 months of regular, unprotected sexual intercourse. Within this context infertility is a medical condition, where individuals that are unable to conceive are identified as having an illness that requires medical intervention (Greil, McQuillan, & Slauson-Blevins, 2011; Bell, 2009; Becker, 2000). The process of labeling infertility as an illness contributes to the medicalization of infertility that has dominated the field of reproductive health since the 1950's, when infertility shifted from a private matter of couples into a medical condition requiring the expertise of a medical professional (Greil, Slauson-Blevins, & McQuillan, 2009). With advancing technologies ranging from fertility drugs to in vitro fertilization (IVF), combined with changing life style choices such as delaying childbirth, the biomedical definition of infertility has increasingly become the socially accepted norm when defining infertility.

There are many reasons why a biomedical approach is useful in measuring infertility. For example, more than 20% of couples will miscalculate the timing of ovulation and will miss their most fertile days (Maheshwari, Porter, Shetty, & Bhattacharya, 2008). Advancing maternal age, weighing too much/too little, and stress are attributed to delayed conception and increasing risks for infertility (Maheshwari, Porter, Shetty, & Bhattacharya, 2008). By waiting 12 months of regular unprotected intercourse, these barriers to fertility may work themselves out if they are truly not an indication of infertility. Furthermore, consideration is given to overall general health or the absence/presence of a prior health condition when couples are trying to get pregnant. For example, if a couple is trying to get pregnant, they may engage in healthy behaviors that improve their chances of fertility (i.e. healthy diet, exercise, quitting smoking) that will eventually impact overall health outcomes, and subsequently influence fertility health. Lastly, reproductive health studies have shown that more than 85% of couples actively trying to get pregnant will do so after 12 months, even after consideration is given to the above factors (Smith *et al*, 2011; Eisenberg *et al*, 2010; Smith *et al*, 2010).

The broader contribution of using a biomedical approach to identify infertility is that it provides a general timeframe (12 months) of allowing conception to occur prior to considering any medical help to get pregnant. The biomedical approach is a useful guide for individuals who are actively trying to get pregnant, and who are tracking the duration of when they started trying to get pregnant and determining when, if ever, they should seek advice or medical treatment. However, the biomedical approach is associated with the medicalization of reproductive health, such that fertility, and subsequently infertility, are considered medical conditions that require medical interventions when complications, like infertility, arise (Domar, Smith, Conboy, Iannone, & Alper, 2009). In this case, any resolutions to infertility that are not medical in nature (i.e. adoption or remaining childless) are often times overlooked or are not considered as possible outcomes. In addition, studies have found that the increased medicalization of infertility is associated with a disregard to the psychological and emotional distress associated with infertility further alienating women and couples from receiving proper mental health support needed during any experiences with infertility (Domar *et al*, 2009). Furthermore, the biomedical approach does not take into consideration any variation in fertility intentions that may occur during the 12 month time frame. Therefore, an alternative method to defining infertility is the demographic approach which takes into consideration the impact of evolving fertility intentions over the life course as well as the social construction of infertility.

Infertility Defined: Demographic Approach

Under a demographic context infertility is defined using multiple measures. First, is self-identification as infertile. Unlike the biomedical approach which defines infertility as the inability to conceive after 12 months of regular, unprotected intercourse, the demographic approach defines infertility only if the individual self-identifies as infertile. In other words, if an individual has been engaging in regular, unprotected intercourse for 12 months or more that has failed to result in pregnancy, they are defined as infertile per a demographic approach only if they recognize the absence of a pregnancy as an indication of infertility (Greil, McQuillan, & Slauson-Blevins, 2011).

The concept of intent is a second measure, where the demographic approach distinguishes between individuals who desire to have (more) children and those who lack a desire for children. For individuals that desire to have children, the inability to conceive, and self-identification as infertile may lead toward HSB for infertility. However, individuals without the desire for children will be less likely to self-identify as infertile and may be less likely to seek treatment. Furthermore, fertility intentions and the desire for (more) children is constantly evolving over the life course (Hayford, 2009). Changes in education, employment, health, or relationship status influence fertility intentions over the life course, and even within the 12-month time-frame defined by the biomedical approach (Greil, McQuillan, & Slauson-Blevins, 2011; Hayford, 2009). Therefore, even in the absence of a pregnancy over a 12-month time-frame, without the intent for (more) children, the inability to get pregnant or carry a pregnancy to term does not identify someone as infertile (Greil, McQuillan, & Slauson-Blevins, 2011).

The fourth measure considered in a demographic approach to defining infertility is the asymptomatic nature of infertility. Infertility according to a demographic perspective is not the presence of a pathogen, but rather the lack of a desired state – pregnancy. Therefore, treatment options should not focus on removing a barrier to fertility, but rather promoting resources that would achieve a desired state (Greil, McQuillan, & Slauson-Blevins, 2011). Similarly, infertility, unlike most medical conditions, can be resolved with alternative options other than medical interventions. For example, adoption, foster-parenting, changing partners, or remaining childless are alternative options to infertility that do not require “curing” the illness/infertility (Greil, McQuillan, & Slauson-Blevins, 2011).

The fifth and final consideration is the social construction of health behaviors and outcomes, but more specifically that reproductive health as a whole, is stratified. The socioeconomic and racial/ethnic stratification that is present within the United States extends to reproductive health. Access to prenatal services, infertility services and treatments, or even insurance plans covering reproductive health is influenced by socioeconomic status in the U.S. Individuals that are marginalized in U.S. society and culture are likely to be isolated from reproductive health resources that would alleviate fertility barriers (Bell, 2009; Nachtigall, 2005). Popular perception of the educated, affluent, and non-Hispanic white women as infertile is vastly different from the perception of the under-educated, poor, minority women who cannot stop having babies (Bell, 2009; Nachtigall, 2005). The impact of social construction of infertility on HSB is observed in the racial/ethnic differences of who actually seeks treatment for infertility, even though rates of infertility are often higher for non-white women (Macaluso et al, 2010; Bitler & Schmidt, 2006).

Infertility Defined: Questions of Intent

Fertility intentions are an important concept when studying fertility and infertility. For example, fertility intentions are not bound by acute states of a desire for children. For example, desires for children will vary over the life course and are influenced by changing social contexts (Greil, McQuillan, & Slauson-Blevins, 2011; Hayford, 2009). In addition, socioeconomic status and cultural circumstances influence ideas of both planning and timing a pregnancy, and subsequently, the concept of intending to get pregnant (Greil, McQuillan, & Slauson-Blevins, 2011; Greil & McQuillan, 2010). However, research on infertility systematically focuses on the individual that is actively seeking help to get pregnant, which implies a very strong desire to get pregnant (Greil & McQuillan, 2010). This can be problematic because individuals that are actively seeking help to get pregnant represent a subset of the infertile population, who are educated, middle-class women, with the resources and skills needed to both access and maneuver through the medical system for infertility assistance (Greil & McQuillan, 2010).

However, conceptualizing infertility based only on fertility intentions subsequently ignores a large portion of individuals who may have experienced any lifetime infertility but have never sought any medical treatment, are those individuals who report evolving fertility intentions over their life course and do not consider the absence of pregnancy to be an indication of infertility, and finally, overlooks any individuals who, in the absence of pregnancy, consider alternative outcomes, like adoption or remaining childless, as resolutions to infertility. Therefore, this research considers the effects of fertility intentions to be secondary characteristics in predicting the rates of HSB and focuses on how in the presence of social factors, biological mechanisms, or contextual effects, the rates of HSB will vary by parity status.

Infertility Defined: Primary and Secondary Infertility

Often times, mainstream perceptions of infertility are the nulliparous couple that has never been pregnant, or, has never had a live childbirth. These couples are experiencing primary infertility. Primary infertility is defined as the inability to get pregnant or carry a pregnancy to term (Simons, 2000). On average, 17% of married or cohabiting women of reproductive age report currently experiencing primary infertility (Stephen and Chandra, 2006). This 17% is assumed to be much lower than the actual percentage of women experiencing any lifetime infertility because it only accounts for individuals that report any infertility complications in the last 12 months (Bell, 2009; Borrero *et al*, 2009; Stephen & Chandra, 2006).

Even more neglected in reports on infertility is the concept of secondary infertility. Individuals experiencing secondary infertility are identified as parous individuals who have had at least one pregnancy end in a live birth, but have been unable to either get pregnant or carry a pregnancy to term again (Simons, 2000). There are different theories on what constitutes secondary infertility in regards to the pregnancy experience for the first pregnancy. For example, the circumstances surrounding changes in partners or utilization of fertility services for the first pregnancy may influence whether a couple is defined as having secondary or primary infertility. According to Greil & McQuillan, (2010), if a woman has a successful pregnancy with one partner, but then she changes partners, any infertility episodes experienced with the new partner would be classified as primary infertility. This is because the infertility is defined as being experienced at the couple level, not the individual level, and a new partner brings with it new indications of potential fertility problems at the couple level. However, the relatively few cases where changes in partners and changes in fertility status occur simultaneously make any further measurement of contributing factors difficult to examine. Because of this reason, and because the NSFG does not provide couple level measures of infertility, I only look at the rates of HSB at the individual, female, level.

According to some clinical-based studies, the rates of HSB for women at risk of secondary appear to be greater than the rates of HSB for women at risk of primary infertility (Davis III, Hall, & Kaufmann, 2007). For example, more than 60% of individuals seeking help to get pregnant are individuals experiencing secondary infertility (Davis III, Hall, & Kaufmann, 2007; Bower, 2005; Simons, 2000). However, additional studies suggest that individuals experiencing secondary infertility are also less likely to seek help to get pregnant and that the actual numbers of individuals experiencing secondary infertility are higher than those actually (Stephen & Chandra, 2000). These studies suggest that individuals experiencing secondary infertility are not seeking help to get pregnant because they already have at least one child which may influence the amount of time and money that individuals are able to put towards infertility treatments, or that infertility services and providers are more accustomed to working with patients coping with primary infertility and patients experiencing secondary infertility may perceive less support from these providers (Davis III, Hall, & Kaufmann, 2007). Further studies have suggested that the lack of social support networks that would be geared towards individuals experiencing secondary infertility, is substantially less than the numerous social networks, online resources, and group-support meetings that are geared towards individuals experiencing primary infertility (Domar *et al*, 2009) The overall message coming from clinical studies regarding the different types of infertility risks is that a large percentage of individuals of reproductive age are experiencing secondary infertility, that secondary infertility may be a more common phenomenon than primary infertility, yet, there is a limited amount of information or resources available to women experiencing secondary infertility. This further elucidates the need to examine the differences in HSB by parity status.

Infertility Defined

For the purpose of this dissertation, I apply a combined perspective using both the biomedical and demographic approach to define infertility. By applying a broader definition of infertility that includes aspects of the biomedical and demographic approaches I am better able to capture health-seeking behaviors for infertility that extend across both primary and secondary infertility. In comparison, if I only used one approach to define infertility I could possible exclude cases where HSB for infertility occurred, but were not observed because they did not meet the definition of infertility. For example, using only a demographic approach to infertility would exclude any HSB for infertility that were observed for single respondents. Therefore, I include aspects of both definitions as the purpose of this study is to look at the differences in HSB for primary versus secondary infertility.

Primary infertility is defined as the inability to get pregnant or carry a pregnancy to term when a woman has never had a live birth. For this dissertation, women at risk of primary infertility are also identified as nulliparous. Secondary infertility is defined as the inability to get pregnant or carry a pregnancy to term, after a woman has had at least one pregnancy end in a live birth. Women at risk of secondary infertility can also be referenced as parous. It is important to mention that within group differences may exist among parous respondents at risk of secondary infertility, such that the HSB within this group may differ if the respondent has 1, 2, 3, or more children. However, the specific focus of this dissertation is to identify if rates of HSB differ for primary versus secondary infertility and focusing on within group differences for respondents at risk of secondary infertility goes beyond the scope of this dissertation.

In addition, Collins *et al* (1986) argues that secondary infertility is not solely defined by the presence or absence of infertility complications in the first or any subsequent pregnancies. For example, a parous woman who had her first pregnancy without using any infertility services, but engages in HSB for infertility for a subsequent pregnancy is identified as experiencing secondary infertility. Likewise, a parous woman did have her first pregnancy occur through infertility assistance, and is engaging in HSB for infertility for her next pregnancy is also identified as experiencing secondary infertility. Therefore, in this dissertation, the risk of secondary infertility is not defined by the presence, or absence, of previous HSB for infertility for prior pregnancies, rather, HSB for secondary infertility are observed among women who are parous – regardless of how the previous pregnancies occurred. Comparing the effects of engaging in HSB for a first pregnancy versus not engaging in HSB for a first pregnancy, among women at risk of secondary infertility, extends beyond the scope of this dissertation and would require retrospective data not currently available through the NSFG.

The importance of identifying differences in the risk of HSB for infertility by parity status is based in part on the projected increase in the number of individuals who will experience any lifetime infertility. Studies have shown that changing social environments, prior reproductive health outcomes, and even state-level mandates surrounding insurance coverage are associated with infertility rates (Martinez, Daniels & Chandra, 2012; Kelly-Weeder & O'Connor 2006). However, not everyone experiencing infertility will seek medical treatment and some who do seek a diagnosis will not follow with treatment (Chandra & Stephen 2010).

Chapter 3

THEORY AND HYPOTHESES

In this chapter I present the theoretical models used to measure the effects of social factors, biological mechanisms, and contextual effects on the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. I begin by introducing the two models of health-seeking behaviors for general health conditions, and propose how components of these models can be applied towards HSB for infertility. This includes the Behavioral Model of Health-Seeking Behaviors and the Health Behavior Model (Bradley *et al*, 2002; Stretcher and Rosenstock, 1997; Andersen, 1995; Janz and Becker, 1984; Becker, 1974; Andersen 1968). Next, I apply my proposed model of HSB for infertility to each of the three research areas of this dissertation. This includes describing the theory and hypotheses for the relationship between social factors, biological mechanisms, and contextual effects on the risk of HSB for infertility by parity status. The overarching purpose of this dissertation it to demonstrate that the risk of HSB, in the presence of social factors, biological mechanisms and contextual effects, is significantly different for women at risk of primary infertility versus women at risk of secondary infertility. As a brief reminder, women at risk of primary infertility are nulliparous women who have never been pregnant, or, have never had a pregnancy end in a live birth and women at risk of secondary infertility are parous women who have had at least one pregnancy end in a live birth.

Health-Seeking Behaviors (HSB)

In general, theories of HSB share the assumption that the progression from observing a symptom to actually seeking treatment is a complex process. There are multiple individual, and demographic factors that influence the decision to seek treatment, which are not mutually exclusive and vary based on the severity or nature of the health condition (White, McQuillan, & Greil 2006; Shaw, 1999). In most cases, the health-seeking process can be viewed in four steps which include observing the symptom, evaluating the severity of the condition, considering possible treatment options, and engaging in behavioral responses (i.e. seeking treatment) (White, McQuillan, & Greil 2006). In the case of infertility, this four-step process is less predictive due to the complex circumstances of defining, diagnosing, and measuring infertility. Therefore, in the following section I introduce two models of HSB that I apply towards general health conditions and outline how these models are applicable when measuring the risk of HSB for infertility.

The first model is the Behavioral Model of Health Services Utilization which was developed in the 1960s to explain why families utilized health care services and to explain sociodemographic disparities among individuals accessing care (Bradley *et al*, 2002; Andersen, 1995; Andersen 1968). The initial Behavioral Model identified predisposing factors, enabling resources, and need factors that influenced the decision to seek treatment. Predisposing factors included demographic characteristics, social structure, and health beliefs like age, gender, race/ethnicity, education and employment (Bradley *et al*, 2002; Andersen, 1995; Anderson, 1968). Enabling resources were identified as individual, family, and community resources as well as social networks, access to health insurance, having a regular health care professional, and/or, having access to a health care facility (Bradley *et al*, 2002; Andersen, 1995; Andersen, 1968). Need factors included an individual's perceived and evaluated need of seeking treatment in light of their functional state of health, and capacity to meet their day-to-day living needs (Bradley et al, 2002; Andersen, 1995; Andersen, 1968). Over time the Behavioral Model developed to include internal factors (exercise, diet and health history), external factors (economic environment), and consumer satisfaction (availability and cost) with health care services to predict HSB for general health conditions (Bradley *et al*, 2002; Andersen, 1995; Andersen, 1968). According to the Behavioral Model, the likelihood of an individual seeking treatment is dependent upon the interaction of predisposing factors, enabling resources, and internal and external factors (Bradley *et al*, 2002; Andersen, 1995; Andersen, 1968).

In my dissertation, I include a variety of the measures presented in the Behavioral Model to test the effects of the social factors, biological mechanisms, and contextual effects on the rates of HSB for infertility based on parity status. A visual conceptualization of the broader HSB model for this dissertation is presented in Figure 3.1. For predisposing factors, I examine measures of age, education and employment. For enabling resources I consider the influence of social networks that include marital or cohabiting unions, and residing in a states with insurance mandates for infertility services. I include internal factors like reproductive health histories and external factors such as having access to affordable health care options for infertility services that come from state residence. For the purpose of this dissertation, I do not include need factors in testing the effects of parity status on HSB for infertility because this would require an estimation of fertility intentions, which extends beyond the scope of this research.

The second health-seeking model I build upon is the Health Belief Model which was developed in the 1950s by social psychologists intending to understand how HSB are influenced by variations in attitudes and beliefs towards individual health outcomes (Stretcher and Rosenstock, 1997; Janz and Becker, 1984; Becker, 1974). According to the Health Belief Model, individuals seek treatment once the following four conditions are met: 1) the individual believes they are susceptible to a undesirable health condition, 2) they perceive the condition to be potentially serious, 3) they determine the benefits of seeking treatment outweigh the costs, and 4) the individual receives internal cues (i.e. presence of symptoms, and unchanging or worsening symptoms) or external cues (i.e. social support, encouragement, or expectations) to seek treatment (Stretcher and Rosenstock, 1997; Janz and Becker, 1984; Becker, 1974). The core assumptions of the Health Belief Model are that individuals are motivated to avoid illness, and, believe that certain behaviors, like seeking treatment, will resolve the presence of any undesirable health outcomes (Stretcher and Rosenstock, 1997; Janz and Becker, 1984; Becker, 1974). In my dissertation, I apply the core assumptions of the Health Belief Model to test the effects of social factors, biological mechanisms, and contextual effects on the risks of HSB, based on infertility status. Specifically, I consider how internal cues like prior reproductive health histories and external cues like being in a committed relationship or having access to insurance coverage for infertility will influence the rates of HSB by parity status.

In addition to these two models of HSB, I also consider how decisions to seek treatment change over the life-course. For example, the pregnancy intentions for an unmarried, 18-year-old high school student is assumed to be very different than the desires of a married 28-year-old woman with a college degree and working in full-time employment. Changes in the level of education, employment and relationship status, and advancing maternal age. fluctuate over the life course, influencing pregnancy intentions, and subsequently impacting the rates of HSB for infertility (White, McQuillan, & Greil, 2006; Hayford 2009; Shaw 1999; Pescosolido 1992). Therefore, in my dissertation I include time-varying measures of selected social factors, biological mechanisms, and contextual effects that are assumed to change over the life-course.

Because infertility is unlike other health conditions with clearly defined symptoms, clearly defined treatment options, or clearly defined predictors of HSB, I am proposing a combined HSB model that includes aspects of the Behavioral Model of Health Services Utilization and the Health Belief Model. This includes an examination of time-varying social factors and biological mechanisms as well any lifetime exposures to contextual effects. More specifically, I develop a broad, theoretical framework that includes testing predisposing, enabling, internal and external factors from the Behavioral Model of Health Services Utilization behaviors and internal and external cues from the Health Belief Model, yet furthermore, I take into consideration changes of these measures over the life course. In the sections that follow, I specifically outline how the components of my proposed HSB model are tested using social factors like education, employment, and relationship status; biological mechanisms like age and reproductive health history; and contextual effects like state-level insurance mandates. More specifically, I intend to demonstrate that the rates of HSB for infertility in the presence of these measures will vary by parity status.

Social Factors and Health-Seeking Behaviors

Evolving social environments since the 1960s, advancements in reproductive technologies, and overall public awareness of the so-called "biological clock" influence fertility trends and fertility-related health-seeking behaviors (Abma & Martinez, 2006). Changing familial and social expectations have led to an increasing number of women pursuing education and employment opportunities, delaying the transition to marriage, and subsequently delaying childbearing (Abma & Martinez, 2006; Thornton & Young-DeMarco, 2001). However, the social-normative trend in the United States promoting parenthood and imposing social expectations for women to become mothers is counterintuitive to these changing social trends that have contributed to delaying childbearing (Thornton & Young-DeMarco, 2001). This in turn, results in women feeling social pressure to become mothers at all costs possible (Mathews & Hamilton, 2009). Furthermore, popular and mass media attention to the so-called "biological clock" has persisted for women, further promoting the social norm/expectation of having children (Thornton & Young-DeMarco, 2001).

I hypothesize that educational attainment, employment status, relationship type, and relationship duration are some of the social factors that not only influence when, or if, a woman has children, but they influence the rates of HSB for infertility. More specifically, I hypothesize that the risk of HSB in the presence of these social factors will be significantly different for women at risk of primary infertility versus women at risk of secondary infertility. It is the comparison of the risks of primary versus secondary infertility that is the leading contribution of the dissertation to the existing literature on HSB and infertility. In the following subsections, I apply the broader model of HSB to propose that the effects of educational attainment, employment status and cumulative years of employment, and relationship type and relationship duration will influence the risk of HSB for infertility, by infertility status. Each subsection begins with the theoretical reasoning why each social factor is included, followed by the specific hypotheses linking each social factor to the risks of HSB for infertility.

Education

Educational attainment is a time-demanding pursuit that provides positive rewards such as greater economic opportunities and alternative sources of self-esteem, but pursuing educational opportunities also contributes to delaying the transition to childbearing (McQuillan, Greil, Shreffler, & Tichenor, 2008). Under these circumstances, education serves a dual role. In one instance, pursuing more education will delay the transition to childbearing, increasing the risks for fertility complications. In the other, having more education increases the personal, financial, and social resources available to engage in HSB for infertility (White, McQuillan, Greil, & Johnson, 2006; Greil & McQuillan, 2004). According to the Behavioral Model of Health Services Utilization, educational attainment is a predisposing factor for HSB where, for example, with more education the more likely an individual is to engage in healthy lifestyle choices and behaviors (i.e. diet and exercise) and less likely to engage in unhealthy lifestyle behaviors (i.e. smoking) (Cutler & Lleras-Muney, 2009). Furthermore, with more education comes a greater sense of control over individual health outcomes, because, with education, an individual is better able to identify health conditions, alter their behaviors to enhance their health outcomes, communicate. For these reasons, educational attainment is a predisposing factor that increases the rates of HSB.

Education - Hypothesis

My overarching hypothesis regarding educational attainment is that with more education, the higher the rates of HSB for infertility. To test this hypothesis I include multiple levels of educational attainment measured as the highest degree completed in the month prior to the risk of HSB for infertility is observed. This first hypothesis proposes that educational attainment, as a predisposing factor and main effect of HSB, will increase the risks for HSB for infertility. To test if there are comparative rates of HSB by parity status, I propose an interaction hypothesis that includes testing the main effect of education with parity status on HSB for infertility. In regards to parity status, I expect to find that with each higher level of educational attainment, the rates of HSB for infertility will be higher among individuals at risk of primary infertility, (i.e. nulliparous women) compared to individuals at risk of secondary infertility (i.e. parous women).

I expect the risks for HSB to be stronger among nulliparous women compared to parous women for two reasons. First, education is a predisposing factor for health outcomes that increases the number of informational, financial and medical resources available to someone seeking treatment for infertility. Second, having more education increases an individual's ability to maneuver through the medical system, to actively participate in their medical treatment, and increases the likelihood that they will have the capacity to follow-through with any treatment plan.

Employment

According to the Behavioral Model of Health Services Utilization, employment, like education, is a predisposing factor that influences health behaviors and health outcomes (Braveman, 2006; Ross & Mirowsky, 1995). For example, full-time employment has been associated with slower declines in perceived and actual health outcomes, reduced rates of poor mental health, and increased likelihood of engaging in desirable health behaviors (i.e. not smoking, or engaging in regular physical activity) (Braveman, 2006). Likewise, employment provides necessary financial resources that contributes to desirable reproductive health outcomes like having access to health-insurance, and even long-term childcare needs like being able to afford quality childcare or educational opportunities (Anderson, Binder, & Krause, 2002; Budig & England, 2001). However, employment has been linked to fertility complications in the sense that delaying childbearing until a career is established increases the maternal age at pregnancy, and subsequently increases risks for infertility (Greil and McQuillan, 2004: Alberts *et al*, 1998). Furthermore, employment can provide alternative sources of happiness stemming from the financial or social benefits of employment, which in the absence of children can provide a sense of life satisfaction (Anderson, Binder, & Krause, 2002; Budig & England, 2001).

Prior to discussing the proposed hypotheses I need to address the link between employment and access to health care coverage. Employment, specifically full-time employment, increases the chances someone will have access to health care coverage. Having health care coverage would presumably increase the likelihood that an individual would engage in HSB for infertility, especially considering the high costs of infertility testing and treatment. However, a limitation of the NSFG data is that information regarding insurance coverage is not time-varying and is not readily available throughout the retrospective employment history. I do not test for insurance coverage as a measure of employment. I do examine a macro-level effect of access to insurance at the state-level in a later chapter on contextual effects and HSB. However, and even in the absence of insurance coverage, examining the link between the predisposing factors of employment for health-seeking behaviors is important because it will shed light on how the social environment of employment as a whole influence health behaviors, but more importantly how employment influences the risk of HSB for infertility based on parity status. Therefore, for the purpose of this dissertation, the specific outcome of employment that leads to increased opportunities for access to health-care coverage are considered secondary effects of employment and are not directly tested in these analyses.

Employment - Hypothesis

My overarching hypothesis for the effect of employment on the risk of HSB for infertility is that being employed in paid, full- or part-time employment increases the risk of HSB for infertility compared to being unemployed or working in non-paid labor. In addition, I expect to find that the risk of HSB for infertility increase with the cumulative number of years of paid full- or part-time employment. In this hypothesis, employment status and the cumulative number of years in paid-employment are the main effect.

To test the effect of parity status, either nulliparous or parous, on the risks of HSB for infertility, I propose an interaction hypothesis where I expect to find that the effect of employment on the risks of HSB will be higher among nulliparous women, or women at risk of HSB for primary infertility compared to parous women, or women at risk of HSB for secondary infertility. I expect to find higher rates of HSB for women at risk of primary infertility because the availability of financial resources that are available through employment are assumed to committed towards the existing children of a parous woman, and therefore, would be less readily available to be used towards HSB for infertility. Therefore, a parous woman, compared to a nulliparous woman, would be limited in her ability to engage in expensive and costly infertility treatments, subsequently resulting in lower rates of HSB. For example, I anticipate that because the parous woman already has a child, and it is assumed that some of the resources provided in an employment environment are put towards caring for that child, the parous woman will have less flexibility in committing her financial or social resources towards HSB for infertility when compared to the nulliparous woman.

In addition to employment status, I look at the effect of cumulative years of paid employment on the risks of HSB for infertility. I expect the relationship between cumulative years of paid full- or part-time employment and the rates of HSB to be stronger women at risk of primary infertility compared to women at risk of secondary infertility. I anticipate that the cumulative years of employment will increase the risk of HSB for primary infertility because with each additional year of employment, there is an increase in the availability of resources, like financial wealth, that allow the nulliparous woman greater ease and access in engaging in HSB. Similar to the hypothesis testing employment status on the risk of HSB, I propose an interaction hypothesis that states the effect of cumulative years of employment on the risks of HSB for infertility will vary depending on parity status.

Relationship Status

Being in a marital or cohabiting relationship is an enabling resource that has been demonstrated to provide significant health benefits for both men and women (Umberson & Montez, 2010; Wood, Goesling, & Avellar, 2007; Waite & Gallagher, 2000). According to the Behavioral Model of Health Services utilization, relationships are enabling resources because they provide emotional and social support, pooling of economic resources, feelings of accountability that reduce risky-health behaviors (i.e. smoking, drinking) and higher rates of desirable health behaviors (i.e. diet, exercise). In this dissertation I propose that the presence of enabling resources within a marriage or cohabiting union, compared to being single, will increase rates of HSB for infertility. I focus on two unique aspects of relationship status to test the effects of HSB. In the first series of hypotheses I propose that the type of relationship will have differential outcomes on the risk of HSB. I look at marriage, cohabiting unions, and being single. In the second series of hypotheses I look at the duration of the relationship type on the effect of HSB for infertility. In the sections that follow I present the theory and hypothesis for these two aspects of relationship status, beginning with relationship type.

Prior to presenting the hypotheses for relationship type and duration I want to briefly address the idea that HSB for infertility can vary by partner. For example, a woman in a cohabiting relationship can have a pregnancy end in live birth without an infertility complication, but perhaps that cohabiting union dissolves after the birth. If the woman goes on to cohabit or marry with a different partner and is unable to get pregnant, then her infertility with her second partner could be defined as primary or secondary infertility. For example, her infertility could be defined as primary infertility in the sense that she is unable to get pregnant, for a first time, with her new partner – therefore, the infertility could be an issue with the partner. However, her infertility could be defined as secondary infertility in the sense that, regardless of the partner change, she has already had one live birth. There are competing theories in regards to when infertility is defined as primary or secondary, however, examining the effects of partner changes on the risk of HSB for infertility would require a within-group comparison among respondents that have already had a live childbirth. Because the focus of this dissertation is comparing the risks of HSB among women at risk of primary or secondary infertility, comparing HSB within groups of women with partner changes and at least one successful pregnancy is beyond the scope of this dissertation at this time.

Additional aspects of relationship status that may affect rates of HSB for infertility are the unobserved characteristics of relationships that influence HSB for infertility, or more specifically, the unobserved fertility preferences of each partner in a relationship (Guzzo & Hayford, 2011; Kodzi, Johnson, Casterline, 2010). For example, the deliberate decision to engage in HSB for infertility is influenced by the observed mechanisms of being in a relationship, the type of relationship, or the duration of the relationship, but the decision to engage in HSB for infertility are also influenced by the unobserved background characteristics of a relationship that can include fertility preferences such as the desired number of children, the timing of having children, or personal beliefs about alternative resolutions to infertility, like adoption or foster-parenting. For these reasons, it is ideal to be able to control for fertility intentions or preferences when testing the effects of relationship status on the rates of HSB for infertility. However, in this dissertation, controlling for fertility intentions is limited due in part to the data structure, but also because only looking at HSB for women with high fertility intentions would shift the comparative focus of the research away from parity status towards fertility preferences.

Relationship Type

In general, social norms and expectations encourage childbearing in marriage versus cohabitation, or within marriage or cohabitation versus being single (Barber, 2001). These social norms are based on the perception that marriage offers a more committed, stable relationship, marriage may provide more financial or emotional resources, and the social support available within a marriage make childrearing more manageable (Barber, 2001). For example, various levels of income within marriage lead to a perception of financial security that increases the chances for having children (Voas, 2003; Schoen et al, 1999; Rindfuss & Parnell 1989). Alternatively, perceptions of financial uncertainty in cohabiting relationships contribute to lower rates of having children and overall, lower numbers of children (Voas, 2003; Schoen et al, 1999; Rindfuss & Parnell 1989).

For these reasons marital unions, more so than cohabiting unions or being single, provide enabling resources that not only promote childbearing, but more importantly, provide resources and support to engage in HSB for infertility. Worth noting is the changing demographic trends like increasing proportions of individuals engaging in a cohabiting relationship before, or even in place of marriage, and the increasing rates of first-born children being born in cohabiting unions which can impact the future rates of HSB in the presence of select relationship types (Martinez, Daniels, & Chandra 2012). It is important to examine the link between relationship type on the rates of HSB for infertility because changing social trends are becoming more supportive of childbearing outside of marriage, and increasing rates of children are being born to cohabiting couples. It makes sense to anticipate that changing trends in fertility outcomes will also include changes in who is seeking help to get pregnant, or, are there different rates of HSB by relationship type.

There are two reasons why I look at relationship type on HSB for infertility. The first has to do with the various levels of enabling resources found within in relationships such as social, emotional, and financial support that would influence HSB for infertility. Due in part to social expectations and norms for childbearing, the availability of various enabling resources like support groups or access to partner's health care plans, there is an assumption that married individuals, more so than cohabiting or single individuals, will engage in HSB for infertility seems. Furthermore, there are traditional demographic trends within relationship types, such that within marriage, the next step would be childbearing and when infertility persists, there are enabling resources available to a married couple that would promote engaging in HSB to resolve this issue. For cohabiting couples experiencing infertility, the availability of enabling resources would be less accessible, compared to a married couple, resulting in fewer social support or networks that would provide encouragement to these couples to seek treatment (Voas, 2003; Schoen et al, 1999; Rindfuss & Parnell 1989). However, examining the effect of relationship type, specifically cohabitation, is necessary given recent trends in fertility and first-babies being born to cohabiting couples (Peterson, Newton, & Rosen, 2003; Waite & Gallagher, 2000).

A related and second reason is the idea that there are more available resources that can be used as coping mechanisms within relationships versus being single, and more so for married individuals versus cohabiting couples. The long-term health benefits within marriage are helpful in protecting against stress and depression associated with infertility as it relates to the perception of a secure, stable, and lasting commitment (Voas, 2003; Schoen et al, 1999; Rindfuss & Parnell 1989). This is not to say that cohabiting or single individuals are lacking in similar coping mechanisms, however the protective effect is more pronounced within marriage (Voas, 2003; Schoen et al, 1999; Rindfuss & Parnell 1989). It is possible, and worth noting, that perhaps within marriage the social pressure and expectations to have children increases the pressure to engage in HSB for infertility and increases the odds that the couple will also seek out support for emotional issues associated with infertility, like depression and distress. Whereas in a cohabiting relationship, the social expectation for childbearing is less demanding upon the couple, and if/when infertility complications arise, there is less pressure or expectation for the cohabiting couple to engage in HSB.

Relationship Type Hypotheses

The hypotheses regarding relationship type and the risks of HSB are based on the ideas that relationships are enabling resources that influence health behaviors and health outcomes, including HSB for infertility. According to the Behavioral Model of Health Services Utilizations, HSB in the presence of certain relationship types, are reinforced through social support networks and access to resources that facilitate the use of treatment services, which are more available and accessible within relationships versus being single. To test the effects of relationship type on the rates of HSB, I only look at the effects of relationship type within the sample of women who are at risk of primary infertility, and again, within the sample of women who are at risk of secondary infertility. At this time, I only test for relationship type differences within the infertility risk types to examine if relationship effects do exist in HSB for infertility.

My overarching hypothesis regarding relationship type is that within the sample of women who are at risk of primary infertility, I expect to find the highest rates of HSB for infertility among women who are married. Women at risk of primary infertility who are in cohabiting relationships will have higher rates of HSB than single women, but the rates for cohabiting women will be lower than the rates of HSB for married women. The comparative analysis for these hypotheses is between relationship types among women who are at risk of primary infertility.

My hypotheses regarding the effects of relationship type for women who are at risk of secondary infertility are similar to the hypotheses above in that I expect to find the highest rates of HSB for infertility among married women who are at risk of secondary infertility. I expect that women at risk of secondary infertility who are in cohabiting relationships will have higher rates of HSB compared to single women, but these rates will be lower compared to married women.

Overall, I anticipate the highest rates of HSB to be observed among women who are married and cohabiting, versus single for both types of infertility risks based on the theory provided by the Behavioral Model of Health Services Utilization that marriage is an enabling resource that promotes engaging in HSB for infertility.

Relationship Duration

In addition to the effect of relationship type on the risks of HSB for infertility, I also look at relationship duration. It is important to consider the duration of a relationship because of the assumption that the longer a couple has been together, the more pronounced the benefits of a relationship will be on increasing the rates of HSB for infertility (Zang & Song, 2007). In this section I outline how relationship duration will have observed effects on the risks for HSB for infertility by parity status.

One of the contributing factors of relationship duration on fertility and infertility outcomes is waiting to have a baby until a suitable partner has been found (Schoen *et al*, 1999). Once a suitable partner has been found, a delay in the transition to childbearing can occur as the relationship develops and becomes established as a stable union (Schoen et al, 1999). Simultaneously, while the relationship is becoming established, the presence of enabling resources that are assumed within a relationship like social, emotional or financial support, are also increasing. Therefore, the longer a couple has been in a relationship, the more likely the benefits of the relationship (i.e. emotional support) have also developed, increasing the rates of HSB for infertility.

Relationship Duration Hypotheses

Overall, I expect to find that the longer a couple has been in a relationship the higher the rates of HSB for infertility. This anticipated outcome is true if someone is at risk for HSB for primary infertility or for secondary infertility. I anticipate this outcome because these relationships have established themselves as committed unions, where the presence of enabling resources has developed and is subsequently providing the needed social, emotional, or financial support to engage in HSB for infertility.

More specifically, I anticipate that when I control for relationship type, and I only focus on women who are married and are at risk of primary infertility, the rates of HSB will be higher the longer the woman has been married. Likewise, I expect to find that among cohabiting women who are at risk of primary infertility, higher rates of HSB will be observed the longer the woman has been in the cohabiting relationship.

I expect these same outcomes when I control for relationship type and look at the rates of HSB for women at risk of secondary infertility. I hypothesize that the rates of HSB for women at risk of secondary infertility will be higher the longer the woman has been married. Similarly, the rates of HSB for women at risk of secondary infertility will be higher the longer the duration of the cohabiting union.

I expect to find that the longer the relationship duration, controlling for relationship type, the higher the rates of HSB for women at risk of primary and secondary infertility based on the idea that over the duration of a relationship, the availability and accessibility of various enabling resources like financial wealth, emotional or mental health and well-being, and social support, are expected to be greater. This, in turn, provides greater access and utilization of medical services, and ultimately increases the rates of HSB for infertility.

Social Factors Theory and Hypothesis Summary

Changes in fertility trends have been observed as women delay childbearing as they pursue their education, establish a career, or as social acceptance of childbearing outside of marriage begin to increase. I propose that the selected social factors, (education, employment, and relationship status) influence the rates of HSB for infertility. In the section on social factors and health-seeking behaviors for infertility I outline how educational attainment, employment status and cumulative years of employment, relationship type and relationship duration will influence HSB for infertility. More specifically, I propose that there is an interaction with parity status in the presence of these social factors that will overwhelmingly increase the risks of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. In the proceeding section, I present the theory and hypotheses which extend the examination of the effect of parity status on the rates of HSB for infertility by outlining two biological mechanisms that have been linked to overall reproductive health.

Biological Mechanisms and Health-Seeking Behaviors

The reproductive lifespan of an individual has biological limitations. For women, the ability to get pregnant depends on a biological start point (menarche) and a biological end point (menopause). Outside of these start and end points, biological influences, such as a prior reproductive health condition like a sexually transmitted infection (STI) can influence a woman's ability to get pregnant. By applying a broad theoretical approach of HSB theories that includes maternal age as a predisposing factors and a previous diagnosis of a STI as internal cues, I propose that the rates of HSB for primary and secondary infertility will increase in the presence of either of these biological mechanisms. In the sections that follow I outline the theoretical reasoning and hypotheses that link maternal age and a history of an STI to the risks of HSB for infertility.

Maternal Age

According to the Behavioral Model of Health Services Utilization, age is a predisposing factor that can determine HSB. In the case of infertility, age is one of the most often cited biological effects for increasing risk of infertility, more specifically, advancing maternal age (Miller, 2010; Abma & Martinez, 2006). In fact, the most common characteristic of women and couples seeking treatment for infertility is that they are over age 30, with a majority being between age 40 and 44 (Chandra & Stephen, 2010). The link between age and infertility is positively correlated where with each year older, the odds for spontaneous pregnancy decrease and health complications associated with infertility increase (Martin 2000). Clinical studies have found that the ability to have a spontaneous pregnancy begin to decrease starting around age 35 (Stephen & Chandra, 2006). Likewise, and in part due to widespread public knowledge about advancing reproductive technologies, many people believe that unmet pregnancy desires can be achieved through some level of medical intervention, and that as a last resort, IVF treatments can fix any infertility problem (Maheshwari *et al*, 2008). However, and even with the financial means or desire to pursue IVF treatments for pregnancy desires, advancing maternal age reduces the success rates of IVF (Maheshwari *et al*, 2008). What's more, there is a common misconception that

IVF will work at any age, with a relatively small proportion of the population aware that the success rates of IVF actually decrease with advancing maternal age (Maheswari *et al*, 2008).

There are many factors that contribute to advancing maternal age at the time of childbirth. These include social factors such as pursuing education, establishing a professional career, postponing marriage, or waiting until you are able to afford quality childcare. In addition, changing social environments, such as the availability and utilization of childcare outside of the home, have encouraged women to pursue education and employment opportunities that in turn, delay the timing of their first birth. A combination of these factors has contributed to the increasing ages at first birth for women in the U.S. (Matthews & Hamilton, 2009). Recent findings from NSFG suggest that the average age at first birth for women in the United States has increased by 3.6 years from age 21.4 in 1970 to age 25.0 in 2006 (Matthews & Hamilton, 2009). The proportion of women who have their first birth at age 35 or older is the primary factor contributing to the age increase at first birth, with nearly 1 of every 12 first births being to women age 35 years or older in 2006, compared to 1 out of 100 in 1970 (Matthews & Hamilton, 2009). However, the increased proportion of births occurring to women of advanced maternal age warrants further examination into the long term impacts on fertility outcomes. By comparison, the almost static rate of percentage of first births to women under age 20 was 21% in 2006 compared to 24% in 1970 (Matthews and Hamilton, 2009).

An additional aspect of the risks associated with advancing maternal age on fertility outcomes are the risks on overall pregnancy health for mother and child. Births at advanced maternal ages (35 or older) are associated with increased risks for fetal chromosomal abnormalities, miscarriages, gestational hypertension and diabetes, and preeclampsia (Ceballo, Abbey, & Schooler, 2010; Davis III, Hall, & Kaufmann, 2007). Multiple births are a risk factor for all women, regardless of age, but the risks for multiple births, even in the absence of fertility treatments, are higher among older individuals (Ceballo, Abbey, & Schooler, 2010; Davis III, Hall, & Kaufmann, 2007). Rates of delivery with forceps or by cesarean section, and risks for stillbirth are also higher among older women (Ceballo, Abbey, & Schooler, 2010; Davis III, Hall, & Kaufmann, 2007). For the baby, deliveries from mothers of advanced maternal ages are associated with higher rates of premature deliveries and low-birth weights (Ceballo, Abbey, & Schooler, 2010; Davis III, Hall, & Kaufmann, 2007).

It is worth noting that the effect of age on the rates of HSB for infertility operates through a process of decreased fecundity, such that with age the odds of spontaneous pregnancy occurring begin to decrease and the odds of infertility or other complications in getting pregnant begin to increase (Bunting & Boivin, 2007). Therefore, the decision to engage in HSB for infertility is also impacted by the process of decreased fecundity and advancing maternal age. However, to control for the effect of fecundity I would need to include measures of fertility intentions and fertility status that is not possible in a retrospective data analysis and it detracts from the focus of comparing rates of HSB by parity status rather than fertility preferences. Therefore, I only look at age on the rates of HSB for infertility and acknowledge that there are unobserved effects of fecundity that may be influencing the decision to engage in HSB as a limitation of this research.

As I detail above, the link between maternal age and pregnancy health outcomes is very well documented. However, what has yet to be fully examined is how maternal age impacts the risk of HSB for infertility. Therefore, I test the effect of maternal age on predicting HSB for infertility, but more specifically, on predicting HSB for infertility based on parity status. Changing social environments that have influenced age at first birth, combined with the fact that advancing maternal age impedes successful, spontaneous pregnancy , promotes further examination of the link between maternal age and HSB for infertility.

Maternal Age Hypothesis

Applying the concepts of the Behavioral Model of Health Services Utilization, I hypothesize that maternal age is a predisposing factor that will increase the rates of HSB for infertility. More specifically, that the effects of maternal age on the risk of HSB for infertility will yield an upside-down “U” shape such that the risk of HSB will increase and then decrease with each year older. To test this hypothesis I run a series of models estimating the effects of age on HSB as a linear and quadratic function (not shown here), a series of single-year dummy-variables, and a set of analyses that tests age in cohorts of 5 years. As with all the analyses in this dissertation, pairs of models were estimated that stratify infertility status into two groups of women, those at risk for primary infertility and those at risk for secondary infertility, and then, fully interactive models were estimated to compare the effects of age on the rates of HSB by infertility status.

In regards to the effect of maternal age on the risk of HSB by infertility status, I hypothesize that advancing maternal age will increase the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. To test this proposed relationship I look at a series of models with maternal age as a linear and quadratic function, as single year dummies, and as age cohorts consisting of five-year groups. I control for variables that may have additional influences on the risk of HSB for infertility, for example, employment or relationship status. I anticipate a stronger effect of maternal age on the risk of HSB for nulliparous women because they have yet to have any biological children of their own. This could be because they have been unable to get pregnant or carry a pregnancy to term, or because they have delayed having children. Because woman at risk of secondary infertility have had at least one live birth, the risks of HSB in the presence of advancing maternal age will still be significant, but not as strong as the effect for primary infertile women.

Reproductive Health History

The second biological mechanism I examine is reproductive health history with a specific focus on any lifetime diagnosis of sexually transmitted infections (STI). The primary reason to consider the link between STI's and HSB for infertility is because STI's are the leading cause of preventable infertility, with chlamydial infection and gonorrhea identified as the primary STI's associated with infertility outcomes (Cates, 2003). Second, because there is a disproportionately higher rate of preventable infertility associated with STI's among women more than men which is a result of the asymptomatic nature of most STI's and the internal reproductive physiology of a woman's body that makes screening and testing for an STI difficult (Meyers, Halvorson, & Luckhaupt, 2007; Kelly-Weeder & O'Connor 2006; Weinstock, Berman, & Cates, 2004). Third, the highest age-specific rates of STI's for women in the United States are 15 to 19 year-olds followed by 20 to 24 year-olds, which represents cohorts of women about to transition into prime reproductive years (Meyers, Halvorson, & Luckhaupt, 2007; Kelly-Weeder & O'Connor 2006; Weinstock, Berman, & Cates, 2004). In addition, the younger age-cohorts are less likely to follow-through with therapy for an STI increasing their risks for recurrent and future STI's (Meyers, Halvorson, & Luckhaupt, 2007; Kelly-Weeder & O'Connor 2006; Weinstock, Berman, & Cates, 2004). Furthermore, public-health information often focuses on educating individuals about preventing unplanned pregnancies or protecting against STI, yet there is very little attention given towards the link between STI and future infertility risks. Therefore it is important to examine the relationship between any lifetime diagnoses of STI on the risk of HSB for infertility, based on parity status.

In this dissertation I consider the effect of any lifetime STI on the risks of

HSB for infertility. I include five different types of STI that include chlamydia, gonorrhea, herpes, genital warts, and syphilis. Aside from the fact that these are the STI variables I have access to from the NSFG survey, these STI's can be linked to negative reproductive and fertility health outcomes. For example, chlamydia and gonorrhea are cited as the STI's most often associated with risks of infertility, which may be related to the fact that these two STI's are the most common STI's in the US (Meyers, Halvorson, & Luckhaupt, 2007; Kelly-Weeder & O'Connor 2006; Weinstock, Berman, & Cates, 2004). In addition, the link between these five STI's and infertility exists because of the asymptomatic nature or dormant periods of the STI that make detection and subsequent treatment difficult. With each infection of one STI, the risks of contracting another STI increase as do risks for HIV, subsequently influencing fertility outcomes (Meyers, Halvorson, & Luckhaupt, 2007; Kelly-Weeder & O'Connor 2006; Weinstock, Berman, & Cates, 2004). Finally, whether treated or left untreated, STI's can lead to severe or permanent damage to the female reproductive organs which impair or prevent pregnancy from occurring (Mathews & Hamilton, 2009).

To test the effects of STI on the risks of HSB for infertility I apply theoretical reasoning from the Health Belief Model that states individuals will engage in health-seeking behaviors after evaluating their health condition in the presence of internal and external cues. In the case of STI and infertility, this four step self-evaluation process is portrayed as the initial concern that the inability to get pregnant or carry a pregnancy to term is an indication of infertility. This is followed by concern that the risks for infertility may be associated with a previous STI, and that the benefits of seeking medical treatment outweigh the costs. Finally, internal cues such as prolonged difficulties in getting pregnant, or external cues such as public health campaigns linking STI's to infertility, will influence the rates of HSB for infertility.

A history of any lifetime diagnoses of an STI acts as an internal cue for HSB for three reasons. First, previous studies have found that STI can increase the risk for infertility (Macaluso *et al*, 2010; Wallace *et al*, 2008; Frost, 2008; Meyers, Halvorson, & Luckhaupt, 2007). This is possible under certain circumstances, beginning with the situation where an individual is infected with an STI but fails to receive treatment in a timely manner, or at all (Wallace, *et al*, 2008; Frost, 2008; Meyers, Halvorson, & Luckhaupt, 2007). Failure to receive treatment for an STI increases the risk of becoming infected with additional diseases which compound to increase the risk for infertility (Wallace *et al*, 2008; Frost, 2008; Meyers, Halvorson, & Luckhaupt, 2007). Second, is the increased risk of infertility from an STI for women more than men, which is due to the anatomical structure of the reproductive organs (Wallace *et al*, 2008; Frost, 2008; Kalmuss & Tatum, 2007; Meyers, Halvorson, & Luckhaupt, 2007). The symptoms of an STI may be less physically visible on a woman's body compared to a man's which may prolong diagnosis and treatment of an STI for women, subsequently increasing the risk for complications associated with infertility (Wallace *et al*, 2008; Frost, 2008; Kalmuss & Tatum, 2007; Meyers, Halvorson,

& Luckhaupt, 2007). Third, is a history of Pelvic Inflammatory Diseases (PID) which is associated with the infection and failure to receive treatment for an STI (Macaluso *et al*, 2010). Women who have an untreated STI have an increased chance of developing a PID, and PID is associated with an increased risk for infertility (Macaluso et al, 2010). In any of these three circumstances a history of an STI could influence the risks for infertility, and when an individual is unable to get pregnant, or carry a pregnancy to term, I propose that the internal cues of a prior STI will predict higher odds of HSB. However, it is worth noting that there may be unobserved mechanisms in which the internal cues of a prior STI operate in predicting HSB for infertility. For example, general health behaviors associated increased risks for an STI infection may be linked with lower odds of engaging in any HSB for any general health conditions, likewise, the diagnosis of an STI may be associated with higher odds of individual perceptions of overall health outcomes (Miller *et al*, 2010; Wimberly *et al*, 2004). Therefore, it would be ideal to control for unobserved, internal cues associated with general health behaviors that would subsequently influence HSB for infertility, however, this goes beyond the data structure of this research, and is such, a limitation of the dissertation.

Reproductive Health History Hypothesis

My overarching hypothesis is that any lifetime STI exposure will increase the risks of HSB for both primary and secondary infertility. In addition, I expect to find higher rates of HSB in the presence of any lifetime exposure to chlamydia or gonorrhea when compared to genital warts, herpes, or syphilis. I expect higher rates for chlamydia or gonorrhea because these are currently the two most common STI's in the United States. In regards to the risks of HSB for infertility by parity status, I expect to find a stronger relationship in the rates of HSB for primary infertility compared to secondary infertility in the presence of any lifetime STI. Likewise, I expect higher rates of HSB for primary infertility versus secondary infertility when there is any lifetime chlamydial or gonorrhea infections compared to the rates in the presence of genital warts, herpes, or syphilis.

In anticipate these outcomes based on the theoretical reasoning of the Health Belief Model that suggests any lifetime history of an STI will influence the decision to seek treatment for infertility especially in the presence of internal cues (i.e. continued inability to get pregnant) and external cues (i.e. public health knowledge linking STI to infertility).

Reproductive Health Theory and Hypothesis Summary

I propose two categories of biological mechanisms that will influence the risks of HSB for primary versus secondary infertility. The first is advancing maternal age which I propose will increase the risks of HSB for both primary and secondary infertility but that the relationship will be stronger for women at risk of primary infertility. The second is any lifetime exposure to STI's including chlamydia, gonorrhea, genital warts, herpes, and syphilis. In the presence of any lifetime STI, I propose that the risks of HSB for any infertility will increase, but that the rates of HSB for primary infertility will be higher than the rates for secondary infertility. It is important to consider the effects of these biological mechanisms on the risks of HSB for infertility because of the increasingly larger proportion of women having children at older ages as well as the higher rates of STI among younger women in the United States. Both of which can have long term effects of fertility trends for the U.S. In the next section I present the theory and hypotheses to test contextual effects on the risks of HSB for infertility.

Contextual Effects and Health-Seeking Behaviors

One of the largest obstacles to seeking help for infertility is the cost of treatment (Schmidt, 2007; Bitler & Schmidt, 2006). Less invasive procedures for infertility, like hormone therapy, can cost between $500 to $3000 dollars per cycle. Tubal surgeries can total upwards of $10,000, and in-vitro fertilization (IVF) averages $12,500 per procedure, and the total cost of just one, medically assisted live birth will cost an average of $44,000 (Smith *et al*, 2010). However, the percentage of individuals who actually seek treatment for infertility related issues is not representative of the number of individuals with any lifetime infertility. In addition to the social and biological cues that may deter an individual from seeking treatment for infertility, access to, and the cost of treatments can also influence health-seeking behaviors. By applying concepts from the Behavioral Model of Health Service Utilization, I propose that state-level insurance mandates regarding insurance coverage for infertility services are enabling resources and external factors that increase the rates of HSB for infertility. In the section that follows I briefly describe the history of the implementation of these state-level mandates and address how these mandates, when interacted with parity status, can be used to measure rates of HSB for infertility.

State-Level Insurance Mandates

Previous research has shown that states with insurance mandates to cover or offer coverage for infertility treatments have unique health outcomes as compared to states without any infertility insurance mandates (Bitler & Schmidt, 2006). For example, states with mandated coverage of IVF have the highest reported rates of IVF usage and the highest prescribed rates of IVF treatment for infertility (Bitler & Schmidt, 2006). Other studies have observed that the rates of twin births to women aged 35 or older are highest in states with infertility insurance mandates (Bitler & Schmidt, 2006). The higher rates of twin births in these states and to women over age 35 may be explained in part by the fact that access to infertility treatments, like IVF, may increase utilization of these treatments and the link between IVF and higher risks for multiple births

In response to the increasing expense of infertility treatment, and in part to the increasing rates of infertility, 15 states have state-level insurance mandates that require group-health insurance companies include coverage for infertility treatment in every policy, or, offer the option of purchasing a policy that would cover infertility treatment. The types of services, procedures, and treatments for infertility that are covered in each policy vary state-by-state. Likewise, some states do not enforce the mandate on health maintenance organizations (HMOs) while other states apply the mandate across all health policies. Table 3-1 lists the

15 states that either mandate coverage for infertility services or mandate an option to purchase coverage for infertility services.

According to the Behavioral Model of Health Services Utilization, HSB for general health conditions are influenced by an interaction of enabling resources and external factors. Enabling resources include access to health insurance, but more specifically, insurance plans that cover infertility treatments. External factors that influence HSB for general health conditions include the availability and costs of the services. In the case of insurance mandates and infertility, residing in a state with state-level mandates for insurance coverage could alleviate some of the high costs associated with infertility treatments, ultimately increasing the availability and accessibility of treatment options. It is important to examine the contextual effects of state-level insurance mandates on HSB for infertility for three reasons. First, the numbers of women who engage in any HSB for infertility are disproportionately fewer than the actual number of women who report any lifetime infertility. Furthermore, the sociodemographics of women who are seeking out treatment are overwhelmingly represented by higher socioeconomic status groups (i.e. educated, employed, high income) (Greil & McQuillam, 2010). By comparing the rates of HSB when insurance coverage is available, it will shed some light on the sociodemographic differences in HSB for infertility by identifying one measure, (insurance coverage) that may contribute to these differences. Second, as the proportion of women who delay childbearing until later or older maternal ages increases due to changing social dynamics, it can be presumed that the rates of women experiencing any lifetime infertility will increase. This logic comes just from the relationship between the increased risks for infertility with advancing maternal age and the assumption that the rates of women engaging in HSB for infertility will also increase. Therefore, examining the effects of state-level insurance mandates on HSB for infertility can specify how a measure that extends beyond the personal control of the individual (i.e. not getting older, or improving socioeconomic status) that may influence HSB. The third and final reason deals with the changing social and political policies for health insurance specific to reproductive health. Ongoing debates as to what to include in insurance mandates for reproductive health currently focus on birth control methods, but, with the high costs of infertility services and treatments, it is plausible to consider that debates about what, and if, to cover infertility services in insurance programs is likely (Bitler & Schmidt, 2006). Therefore, this study aims to identify if there is indeed observable differences in the risk for HSB for infertility in the presence of state-level mandates for coverage or offer-to-cover, based on parity status,

State-Level Insurance Mandates Hypotheses

Before discussing my detailed hypotheses in regards to the interaction between residing in a state with insurance mandates and parity status, I propose an overarching hypothesis for state-level insurance mandates and HSB for infertility. I hypothesize that rates of HSB for infertility are more likely to be observed among women residing in states with state-level infertility insurance mandates (to cover or offer-to-cover) compared to women residing in states with no state-level mandates. Based on the Behavioral Model of Health Services Utilization, the higher expectation of HSB for infertility in states with mandates stems from two assumptions. First, treatment for infertility is very costly and living in a state with insurance is assumed to alleviate some of the financial costs of seeking treatment for infertility, therefore, increasing the likelihood that someone will seek treatment for infertility (Schmidt, 2007; Bitler & Schmidt, 2006). In this regard, state-level insurance mandates act as an enabling resource that increases the likelihood of utilization. Second, external factors such as increased public awareness of infertility treatment options are associated with living in a state with infertility insurance mandates (Schmidt 2007; Bitler 2006; Bellevue 2000). I anticipate this relationship for four reasons. First, women in these states are assumed to have greater public knowledge about infertility and more importantly, about infertility clinics that are available to help them with infertility complications. Second, having insurance to help defray the costs of infertility treatments will increase the likelihood that someone will, at the very minimum, explore treatment options. Third, having insurance that covers infertility can increase the availability of networks of physicians that are experts in the field of infertility, yet are affordable because of the insurance coverage. And finally, it may be that within the professional network of physicians there is shared knowledge or information about what services are provided by certain health care professionals, therefore making referrals based on services needed and the type of insurance-coverage included more feasible.

Therefore, the overarching hypothesis linking contextual effects to rates of HSB for infertility is that residing in a state with state-level insurance mandates will increase the rates of HSB for infertility.

In regards to the effects of state-level insurance mandates on the rates of HSB by parity status, I hypothesize that women at risk of primary infertility, who live in a state with state-level insurance mandates, will have higher rates of HSB compared to women at risk of secondary infertility residing in states with insurance mandates. I expect to find the relationship between state-mandates for infertility coverage and HSB for infertility stronger among women at risk for primary infertility, compared to women at risk of secondary infertility, because the presence of insurance mandates acts as an enabling resource that can assist with the cost and availability of accessing infertility services and treatments and because residing in states with insurance-mandates may increase overall public awareness that the costs associated with infertility treatments are partially covered by insurance plans, ultimately increasing the rates of HSB for women at risk of primary infertility.

Contextual Effects Theory and Hypothesis Summary

There are two overall contributions of the research linking state-level infertility insurance mandates to the risks of HSB for women at risk of primary versus women at risk of secondary infertility. First, the expense of infertility treatments will continue to become a public policy issue with public health and advocacy groups expecting mandates for infertility coverage to become more prominent. This is in response to the growing rates of infertility currently in the United States and the projected population structure changes that allow women to delay childbearing and desiring (more) children at later, more advanced maternal ages, which is associated with increased risks for infertility (Schoen *et al*, 1999). Second, studies looking at state-level mandates for infertility insurance have never examined the differences in health-seeking behaviors by parity status. This dissertation is the first look into how parity status combined with state-level mandates will influence health-seeking behaviors. This in turn, influences whether future mandates and public policies are developed in consideration to the women who are at risk of primary infertility or secondary infertility.

Chapter Summary

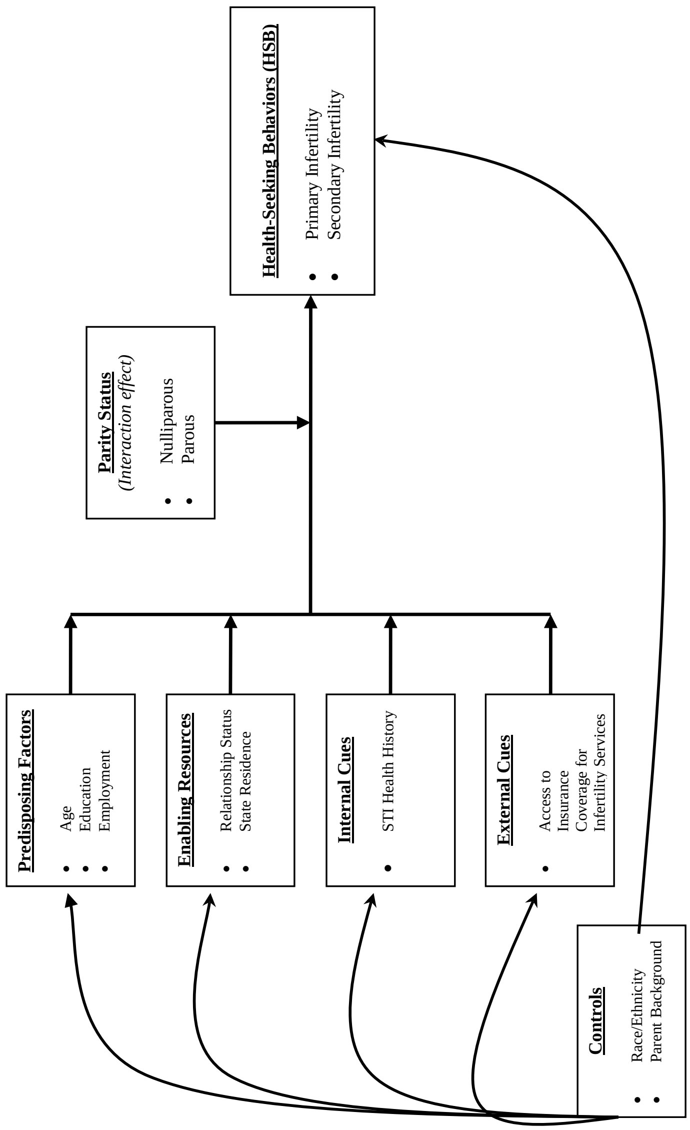
In this chapter I outline how select social factors, biological mechanisms, and contextual effects can be used to estimate the rates of HSB for infertility. More specifically, these three pathways can be used to evaluate the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. I introduce two broad theories that I apply in testing the effects of social factors, biological mechanisms, and contextual effects. In the Behavioral Model of Health Services Utilization theory, predisposing factors like age, education, and employment, combined with enabling resources like relationship status and residing in states with insurance are associated with increasing the odds of HSB for infertility. In the Health Belief Model, internal cues like a previous diagnosis of an STI and external cues like having access to insurance coverage, based on state residences, are associated with the odds of HSB for infertility. Therefore, I propose that the effects of social factors like educational attainment, employment status, and relationship status, the effects of biological mechanism like maternal age and STI diagnosis, and contextual effects like residing in a state with state level mandates will influence the rates of HSB. However, in this chapter I outline how the effects of these factors will significantly vary on the rates of HSB for women based on whether they are at risk of HSB for primary infertility versus HSB for secondary infertility. In the next chapter I describe the data construction and methodology for testing these hypotheses.

Table 3-1: States that Mandate Insurance Programs Cover, or Offer-to-Cover Infertility Services

	Year Mandate Enacted	Mandate to Cover Infertility Insurance	Mandate to Offer Coverage
Arkansas	1987	Cover	
California	1989		Offer
Connecticut	1987	Cover	
Hawaii	1991	Cover	
Illinois	1991		Offer
Louisiana	2001		Offer
Maryland	1985	Cover	
Massachusetts	1987	Cover	
Montana	1987	Cover	
New Jersey	2001	Cover	
New York	1990	Cover	
Ohio	1991	Cover	
Rhode Island	1989	Cover	
Texas	1987		Offer
West Virginia	1977	Cover	

Source: Retried from RESOLVE (http://www.resolve.org) on April 20th, 2012.

Figure 3-1: Theoretical reasoning linking Social Factors, Biological Mechanisms, and Contextual Effects to Health-Seeking Behaviors by Parity Status



Chapter 4

DATA AND METHODOLOGY

In this chapter I introduce the data source, the National Survey of Family Growth (NSFG), and describe why the NSFG is the most appropriate data for this dissertation. This is followed by describing the research design and analytical procedures for the series of hypotheses linking social factors, biological mechanisms, and contextual effects to the risks of HSB for primary and secondary infertility, with a brief summary included at the end of the chapter.

National Survey of Family Growth

Throughout the discussion of the sample design of the NSFG I draw upon the National Center for Health Statistics report on the planning and development of the 2006-2010 NSFG survey design (Groves, Mosher, Lepkowski, & Kirgis, 2009). Established in 1971 by the National Center for Health Statistics (NCHS), the NSFG was developed as a nationally representative sample providing information on fertility trends for women in the United States. There have been six data collection cycles of the NSFG since 1971 with cycles consisting of planning, pre-testing, fieldwork, data processing, preparation and documentation. Interviews in each cycle were completed in twelve months or less, and the year listed is the year in which the interview was conducted. Cycles 1 (1973) and 2 (1976) included married, ever-married, or never-married mothers; never-married, childless women were not included in these cycles. The focus of Cycles 1 and 2 was pregnancy and marriage histories, contraceptive use, and birth intentions;

oversampling was done with non-Hispanic Black women. Cycle 3 (1982) included all women ages 15-44 regardless of marital status. In addition to the content covered in Cycles 1 and 2, Cycle 3 expanded to include histories of sexual activity and family planning with oversampling extended to teens. Cycle 4 (1988) maintained the same sampling distribution of women 15-44 years of age, and added questions on cohabitation, adoption, and STI. Starting with Cycle 5 (1995), interviews were conducted using computer-assisted personal interviewing (CAPI), several event histories were included in the survey that looked at education, work, cohabitation, marriage, contraception and pregnancy histories, and an audio computer-assisted self-interviewing (ACASI) system was established allowing respondents to privately hear and respond to questions deemed most sensitive. Furthermore, Cycle 5 began including a contextual data file that included characteristics of the respondent's residence. Oversampling in Cycle 5 now included Hispanic women in addition to non-Hispanic blacks and teens. Cycle 6 (2002) included, for the first time, a survey developed specifically for males ages 15-44, and revisions on ACASI questions that included more details on risk behaviors associated with HIV and STD.

2006-2010 NSFG Continuous Data File

In response to the growing challenges of collecting sufficient numbers of surveys, due in part to changing household eligibility demographics, declining interests to participate in survey interviews, and the administrative cost of conducting a complex survey design, a continuous data collection process was implemented for survey years 2006-2010. There were no major content-based revisions between the Cycle 6 (2002) and 2006-2010 continuous data file with only minor, technical revisions implemented to improve the structure and flow of the survey. The overall benefit of redesigning the NSFG survey into a continuous data collection project was a reduction in costs associated with hiring, training, interviewers as well as improving overall data collection efficiency, and increased survey responses.

2006-2010 NSFG Sample Design

The design of the 2006-2010 data file was based on a national sample of 110 primary sampling units (PSUs) consisting of counties or groups of adjacent counties. Each of the 110 PSUs was divided into four, nationally representative parts, called national quarter samples, which were surveyed over the four year data collection process. Within each of the national quarter samples, 8 of the largest metropolitan areas, and 25 smaller metropolitan and non-metropolitan areas were sampled. The same 8 largest metropolitan areas were sampled every year, whereas the 25 smaller areas were rotated for each survey year. Random selection of one of the national quarter samples was selected for the first survey year (2006) and was not replaced for re-sampling in the following survey years.

For each of the 110 PSUs, in each of the four national quarter units, secondary units, called segments, were selected and included neighborhoods or adjacent neighborhood blocks. Segments were grouped into four domains based on the racial/ethnic composition of housing units in that segment, in the 2000 U.S.

Census. The racial/ethnic composition of each domain is summarized below.

1) Domain 1: housing units with less than 10% black persons and less than 10% Hispanic persons
2) Domain 2: housing units with more than 10% black persons and less than 10% Hispanic persons
3) Domain 3: housing units with more than 10% Hispanic persons and less than 10% black persons
4) Domain 4: housing units with more than 10% black persons and more than 10% Hispanic persons

Oversampling of housing units in Domains 2, 3, and 4 were conducted to increase the percentage of black and Hispanic persons in the survey. After housing units were selected for sampling, an NSFG interviewer would visit the household to conduct a screener interview with all persons living at the residence where listed. If there was one person age 15-44 living at the residence they were asked to participate in the survey; if there were two more eligible individuals, one was randomly selected to participate. If no one was between the ages of 15-44, the household was not eligible to participate in the survey. Each person interviewed was assigned a sampling weight to correct for oversampling, non-response, and non-coverage errors. Each persons sampling weight can be interpreted as the number of people in the population that the person represents. Finally, all interviews for the 2006-2010 began on July 1st of the corresponding year and there were over 5,000 men and women interview annually, during the four year survey period.

The NSFG and Predicting HSB for Infertility

The extensive survey history of the NSFG has provided population level demographics and trends in regards to reproductive, pregnancy, and infertility trends that have not been provided by any other data source. Because of the history and validity of the NSFG to provide the most widely accepted statistics in regards to reproductive health, the NSFG is ideal for these data analyses. In addition, the NSFG survey structure provides detailed retrospective histories that have beginning and ending dates for items such as education, employment, relationship transitions, dates for health-seeking behaviors for infertility, and pregnancy histories. For these reasons, the NSFG data files are the most appropriate sources of information when testing the effects of social factors, biological mechanisms, and contextual effects on HSB for infertility.

Research Design and Methods

The analytical procedures for this dissertation come directly from the hypotheses detailed in Chapter Three and in the following subsections I describe each set of analyses used to test the proposed hypotheses.

Social Factors and Health-Seeking Behaviors for Infertility

To test the effects of social factors on HSB for infertility I use retrospective data from the female respondent and pregnancy history files of the NSFG 2006-2010 continuous data file. The method of analysis is discrete-time event history models. The dependent variable is the rates of HSB for help to get pregnant or carry a pregnancy to term. Because not all respondents are at risk for HSB for infertility, and the dependent outcome may be right censored, event history methodology is the most appropriate technique (Allison, 1982). The dependent variable is constructed from the female respondent file and includes all respondents who have ever had sexual intercourse with a male partner, or are at least 18-years-old.

In these analyses, the risk of HSB for infertility is determined based on parity status. For women at risk of HSB for primary infertility, the hazard begins at age 15, which is the earliest age reported of having sex with a man by a respondent in this sample. Even though the likelihood of HSB at an age younger than 18 is very low, I start the hazard at age 15 based on the logic that once the risk of pregnancy begins, so begins the risk of infertility, and subsequently, the risk of engaging in HSB for infertility. For women at risk of HSB for secondary infertility, the hazard begins at the century month of their first live birth. I start the hazard when the first birth has occurred because a woman cannot be at risk for secondary infertility if she has not already had at least one successful pregnancy.

The dependent outcome in these analyses is the rates of HSB for infertility. The dependent variable is 0 for every person month that the female has no HSB for infertility. When the female respondent reports any HSB for infertility, the outcome is coded 1 and the female is removed from the analysis. At the end of the observation period, which is the end date for the interview survey, any female respondents with no HSB for infertility are censored. Female respondents younger than age 18 and those who have never had sex with a man are removed from the analysis because they were not asked any of the health-seeking behavior questions for infertility based on the survey design and skip patterns of the NSFG. In total, there were 902 cases removed through list wise deletion because respondents were not asked questions about HSB for infertility. Listwise deletion is an appropriate method for dealing with missing data and minimizing any bias effects on the outcome. The final sample size for these analyses is 11,210 cases.

The main effects for these analyses are the various social factors included such as education, employment, and relationship status. These main effects are interacted with parity status and the variable construction for these main effects will be discussed later in this section. A female respondent is observed in one of two parity conditions: parous or nulliparous. A female identified as parous will have at least one pregnancy history that ended with a live birth. A parous woman in these analyses is identified as being at risk for secondary infertility. A female is identified as nulliparous if she has never been pregnant, has never been able to carry a pregnancy to term, or, if she has been pregnant, but the pregnancy did not end in a live birth. A nulliparous woman is identified as being at risk for primary infertility. Parity status is a dichotomous variable where parous females are coded 1 and nulliparous females are coded 0.

Although it is possible that there are within-group differences of HSB, for example, that the HSB for women at risk of secondary infertility varies dependent on the number of children she has had, the purpose of this research is to identify the difference between groups of women at risk of primary versus secondary infertility. Therefore, the dichotomized coding of the parity status variable suggests that having at least one live birth, or being parous, is a permanent effect that will influence the outcome of HSB for infertility differently when compared to a nulliparous woman and when other independent variables are present. This permanent effect is assumed constant even in the presence of more than one pregnancy.

Controls for these analyses include race/ethnicity, age and a series of variables from the respondent's childhood used as a proxy for current socioeconomic status. HSB for most medical treatments are influenced by the vastly different social cues, enabling conditions and predisposing conditions that are present for women of various racial/ethnic backgrounds. HSB for infertility is not immune to the effects of race/ethnicity on treatment seeking behaviors (Greil *et al*, 2007). Therefore, I control for race/ethnicity with a series of dummy variables predetermined by the NSFG survey design. I control for race/ethnicity instead of including it as a social factor for two reasons. First, I am already dividing the sample into groups by parity status and to do this by race/ethnicity would further minimize the groups of women in each parity category, negatively impacting the power of the analyses. Second, the relationship between race/ethnicity on fertility outcomes is very detailed and would require more specific focus on the social construction of race/ethnicity and health conditions that goes beyond the scope of this dissertation. The dummy variables for race/ethnicity include non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other. Female respondents are counted in only one of these categories and non-Hispanic white is the reference group.

I control for age and parameterize the baseline hazard through a series of six dummy variables for 5-year birth cohorts that include ages 15-19, 20-24, 25-29, 30-34, 35-39, and 40-45. The last cohort is a 6-year cohort because a small sample of female respondents (N=4) were age 44 at the time of interview screener but had their 45th birthday prior to the actual interview. Age is an important control for predicting the HSB of infertility because of the changing age patterns at first birth and age if/when someone seeks infertility assistance and by controlling for age, I am able to minimize other confounding effects of age in the presence of other predictors in this dissertation. In the analyses of maternal age, I test specifically for age and control for other social factors.

Several sociodemographic characteristics from the respondent’s childhood were included as controls in an attempt to apply a perceived measure of childhood socioeconomic status to the respondent’s present day socioeconomic status. I use childhood sociodemographic variables because I do not have this information in a time-varying format available at the time HSB for infertility may occur. To begin, I include a measure for the martial status of the biological parents at the time of the respondent’s birth which is coded as either separated or married; married is the reference category. Highest educational attainment for the respondent’s mother is measured as less than a high school degree or at least two years of college with a high school degree as the reference group. Data from the NSFG only provides information regarding the mother's work status during the respondent's childhood, therefore I only control for mother's work history. This is coded as never working during the childhood with working full or part time during the respondent's childhood as the reference. I include a measure of the pregnancy history for the woman who raised the female respondent. This is the age the respondent's mother had her first child and is coded as less than 19 years old, between ages 20 to 24, between ages 25 to 29, and age 30 or older. The reference for age at first birth is age 20 to 24. Selection of these baseline measures to be used as a proxy for socioeconomic status come from previous literature that suggests adolescent perceptions of childhood socioeconomic status are relatively accurate in predicting future adult socioeconomic status, and a reliable measure in identifying determinants of individuals health outcomes (Goodman *et al*, 2007).

To test the effect of social factors on HSB for infertility I include four independent variables that include highest level of education, employment status, relationship type, and relationship duration. The highest level of education is a time-varying dichotomous variable where a 1 indicates that the female respondent has the educational level and a zero 0 indicates they have not. There are four distinct educational levels included: 1) no high school or GED degree, 2) high school or GED degree, 3) a bachelor's degree and 4) a graduate degree including a Master's and PhD. Educational attainment is important to include because of the dual role education has on predicting HSB for infertility. In one case education attainment may delay childbearing and increase the risk of infertility, and subsequently HSB for infertility. Alternatively, having more education can also increase the number of resources available to someone who faces infertility making the decision to seek treatment more feasible.

Employment status is an important measure to include when testing the effect of social factors on the risk of HSB for infertility because employment is associated with greater access to financial and social support resources that influences the decision to utilize health services as well as the ease of accessing these services. There are two measures of employment included in the analyses. In the first, employment is a time-varying dichotomous variable coded 1 if the respondent was working in full- or part-time employment in the month prior to the risk of HSB and coded 0 otherwise. The second measure is a time-varying interval-level variable that measures the cumulative number of years the female respondent was working in full- or part-time employment at the time of the risk for HSB for infertility. Using two measures of employment is important because I can test the effect being employed in either full or part time employment on the risks of HSB for infertility based on the presence of predisposing factors that come with employment. However, I can also measure the effect of the cumulative number of years of employment on the risk of HSB as it may vary by parity status. The reference for the employment variables are women who were not employed at the time of risk for HSB for infertility.

To test the effects of relationship type on the rates of HSB for women at risk of primary or secondary infertility, I include three time-varying dichotomous variables coded 1 if the respondent was in that relationship type or 0 if she was not. These categories are 1) not in a relationship because she was single, divorced, or separated, 2) cohabiting or 3) married. It is possible that a respondent can move between these types of relationships during the period of observation, but because the purpose of this research is to look at the effect of parity status on HSB, I am interested in looking at the effect of relationship status at the time of risk for HSB and not the effect of relationship transitions on HSB. Therefore, the number of times a respondents has moved between a single, cohabiting, or married relationship is not included in these analyses, but rather the type of relationship she was in the month prior to the risk of HSB. To capture any effect of parity status on the risks of HSB, I look at the effect of relationship type, controlling for relationship duration among women at risk of primary infertility, and again among women at risk of secondary infertility. By approaching the analyses of relationship type in this manner, I am able to observe any effects of relationship type among nulliparous women and among parous women.

The second aspect of relationship status included in these analyses is the duration of the relationship at the time of risk for HSB for infertility. In these analyses, I control for relationship type and use a series of time-varying dichotomous variables for relationship duration that include: 1) in a relationship for less than one year 2) in a relationship for 1 to 3 years 3) in a relationship for 3 to 5 years, and 4) in a relationship for 5 or more years. The fifth category is also the reference group and refers to individuals who are single, or not in a relationship. I include these particular categories based on the idea that the transition from beginning a relationship into parenthood varies by the age of the couple, their socioeconomic status, and race/ethnicity (Furstenberg, 2010). The analyses testing the effects of relationship duration control for relationship type, leaving single as the reference group, and consist of a series of models where I look at differences in the effects of relationship duration on the rates of HSB for infertility. This is done within groups of women at risk of primary infertility and repeated within groups of women at risk of secondary infertility. The comparative focus in these analyses is between relationship duration. If there are significant differences in the effects of relationship duration among the parity types, this is identified with an ‘X’ indicating significant differences by duration at the .05 level.

Biological Mechanisms and Health-Seeking Behaviors

I apply two unique analytical approaches to test the effects of biological mechanisms on the rates of HSB for infertility by parity status. In the first, I use an event-history discrete-time analysis to test the effects of maternal age on the risk of HSB by parity status. In the second, I use a logistic regression to test if any lifetime exposure to an STI can predict HSB for infertility. In the section that follows I begin describing these two distinct methodologies by first presenting the event-history analysis testing maternal age on the risks of HSB for infertility.

To test the effect of maternal age on the rates of HSB for infertility I use retrospective data from the NSFG 2006-2010 female respondent and pregnancy data files. I use the same sample in the analyses for biological mechanisms as I do for the social factors analyses which include all female respondents who have ever had sexual intercourse with a male partner or are at least 18-years-old. The dependent outcome for these analyses is any lifetime health-seeking behavior for help to get pregnant or help to prevent a miscarriage. The dependent outcome is detailed above in the section pertaining to social factors, but I briefly summarize the dependent outcome here: every person-month that the respondent does not engage in any HSB for infertility is coded 0 and the person-month when the respondent does seek HSB is coded as 1. After reporting any HSB the female respondent is removed from the analyses. The primary predictor for these analyses is the parity status of the respondent which determines whether the respondent is identified as being at risk for primary infertility (nulliparous) or secondary infertility (parous).

Controls for the analyses of maternal age and HSB include the childhood sociodemographic variables described in the section on social factors and include the marital status of the biological parents at the respondent's birth, mother's highest level of education, mother's employment status during the respondent's childhood, and the age the respondent's mother had her first baby. In addition, I control for the race/ethnicity of the respondent. Non-Hispanic white is the reference with non-Hispanic black, Hispanic, and non-Hispanic other included in the analyses.

Because I am interested in the effect of maternal age as a biological predictor on HSB for infertility, I control for factors that could contribute to delaying childbirth and increasing the age at first and subsequent births. This includes controlling for the respondent's highest level of education, employment status, years of employment, and relationship status. It is important to control these social factors because they can contribute to childbearing at older ages and in these analyses I am interested in looking at the effect of age independent of these social and other sociodemographic characteristics.

To test the effect of maternal age on HSB for infertility I estimate age in a series of single year dummy intervals, age cohorts of 5 years, and in a linear and quadratic form. The single year dummy intervals begin with age 15 and end with age 45, with age 15 as the reference group. Looking at the effect of age on HSB in this manner allows me to observe the changes in HSB for each year older. However, I anticipate that any observed effects of age on HSB by single-year dummies will be very minimal; therefore, I also estimate models where age is coded into cohorts of 5 years. There are six, five-year cohorts which include: age 15-19, age 20-24, age 25-29, age 30-34, age 35-39, and ages 40-45. This last cohort (age 40 to 45) is actually six years and includes the four respondents who were age 44 at the NSFG screener, but turned 45 at the time of the interview. The unit of time for these analyses are in century-months but have been recoded into 1-year increments for simplicity and based on the fact that changes in HSB for infertility are more likely to be observed across the age-span by years rather than by century-months. Put another way, I do not expect to see much variation in HSB by a one unit change in century-month as much as I expect to see the change in HSB by a one unit change in years.

Because the purpose of this dissertation is to compare of the rates of HSB for primary versus secondary infertility, I run pairs of fully interactive models that stratify by parity status and subsequently test the effects of age on HSB. In Chapter Six I present the results of these models in tables that indicate if there were significant ($p<.05$) differences by parity status.

The second method I use to examine the effects of biological mechanisms on the odds of HSB for infertility is a logistic regression. I use a logistic regression for these analyses for two primary reasons. First, the NSFG does not provide time-specific information regarding the dates of diagnosis of an STI. Instead, survey respondents are asked if they have ever been diagnosed with an STI. Because I do not have the time-ordering of the STI relative to the risk period of HSB for infertility, I cannot estimate an event-history analysis. The second reason is based on the idea that when an outcome measure can be dichotomized into two distinct categories, a logistic regression is appropriate (Allison, 1999). For example, in the analyses on STI and HSB for infertility, the outcome is dichotomized as any HSB for infertility (coded 1) or no HSB for infertility (coded 0). Even though using a logistic regression is limited in accurately identifying the predictive effect of any lifetime diagnosis of an STI on the odds of HSB for infertility, it is still useful in providing a preliminary understanding of the relationship between STI's and the odds of HSB for infertility.

The outcome measure for the logistic regression analyses is any lifetime HSB for infertility. If, at the time of the NSFG interview, the respondent reports that she has ever sought help from a medical provider to get pregnant or carry a pregnant to term, she is coded 1 for any lifetime HSB, otherwise coded 0.

The main effect for these analyses is any diagnosis of an STI, at the time of the NSFG interview. I consider a series of analyses that look at different variations of an STI diagnosis in predicting HSB for infertility. The first set of models tests whether specific types of STI have more or less influence in the odds of HSB for infertility. I include five different STI's that were available through the NSFG data file, and that have been previously linked to risk factors associated with infertility. The five STI are chlamydia, gonorrhea, herpes, genital warts, and syphilis. If a respondent reports any lifetime diagnosis of the STI, at the time of the NSFG interview, she is coded 1 for that STI, otherwise coded 0. The STI categories are not mutually exclusive and it is possible that a respondent can report having more than 1 STI. Because respondents can be observed in more than one individual STI categories, I run a second series of models that looks at any lifetime diagnosis for any of the five STI. In this scenario, a respondent is coded 1 if she reports any lifetime diagnosis for any one of the five STI: chlamydia, gonorrhea, herpes, genital warts, or syphilis. If the respondent reports no diagnosis of an STI at the time of the NSFG interview, she is coded 0 for STI.

Since the focus of this research is on comparing HSB for women at risk of primary infertility versus secondary infertility, I run a series of models to test the odds ratios by parity status. If, at the time of the NSFG interview, the female respondent has never been pregnant, or never carried a pregnancy to term, she is identified as nulliparous and is coded 0 for parity. If, at the time of the interview, the respondent has already had at least one live birth she is identified as parous and is coded 1 for parity.

In the second set of models testing parity status, I look at the odds ratios relating STI and HSB for infertility for nulliparous women only, and then for parous women only. In the third set of models, I look at the odds ratios relating parity status to HSB for infertility for women with any lifetime diagnosis of an STI first, and then women without any lifetime diagnosis. In these models, no lifetime diagnosis of an STI is the reference group.

A fourth and final set of models considers an interaction effect between STI and parity status. The decision to run logistic regression analyses with an interaction effect is based on previous studies looking at risk factors for breast cancer treatment behaviors (Bagley, White, & Golomb, 2001; Lipkus, Iden, Terrenoire, & Feaganes, 1999; Tambor, Rimer, & Strigo, 1997). In these interaction models, having an STI diagnosis is interacted with a nulliparous status (parity = 0) and parous (parity = 1). In this fourth model, the reference group is individuals that have never been diagnosed with an STI

The reason to run these four similar, yet different models is to test all possible variations in the effects of an STI diagnosis on the odds of HSB for either primary or secondary infertility. By looking at the series of models with and without interactions I can identify any comparative differences by parity status.

The controls for the logistic regression models testing the effects of STI on HSB for infertility are the same as the controls for the event-history analyses. The only difference is that the controls are not time-variant and are measured at the time of the NSFG interview. The controls include the respondent's race/ethnicity, five-year age cohorts, highest degree completed, employment status, relationship status, and sociodemographic characteristics of the respondent's parents. The reference groups for the controls are non-Hispanic whites, respondents aged 15-19, less than a high school degree, not employed in full- or part-time work, and being single/not in a relationship.

Contextual Effects and Health-Seeking Behaviors

To test the effect of residing in a state that has state-level insurance mandates infertility services and treatments I use retrospective data from the NSFG female and pregnancy files combined with variables from the contextual data file. The three files were merged together using the respondent's case-number identifier. In the section that follows I outline the variable construction for the state-level identifier and identify the controls used for these analyses.

The first identification process for state-residence comes from a variable in the NSFG public data file that asks if respondents were living in the same state in 2000 that they were living in at the time of the NSFG interview. If respondents reported that yes, they lived in the same state from 2000 until the NSFG interview, then a state-level variable from the contextual data file indicates what state they lived in. Respondents are coded 1 for the state they lived in since 2000. Respondents can only be coded 1 for living in one state. If, however, respondents report that they did not live in the same state since 2000 they are removed from the sample. The NSFG does not ask any follow-up questions regarding state residence from 2000 and therefore, I make the decision to remove these cases because I am unable to accurately test the effects of state-level mandates on the rates of HSB without having some history regarding states residence. This is a limitation of the NSFG data design. To overcome this limitation, I approach testing the contextual effects in a series of analyses which I will address briefly after further describing the state-level variables. All 50 U.S. states, including Washington D.C. are included in the state variable. Respondents are observed as living in only one of the 50 states. Since the NSFG only interviews, civil, non-institutionalized members of the U.S. population, consideration for military personnel that are stationed over-seas, but have U.S. state address is not an issue.

A limitation of the analyses on the contextual effects is that state-of-residence prior to 2000 is unknown, and therefore testing for the effects of state-mandates on the rates of HSB prior to 2000 is problematic. However, the unique aspect of this particular research question is the fact that no other research has consider the effect of residing in a state with state-level insurance mandates on the rates of HSB. Therefore, approaching an analysis of these measures in unique and creative ways provides the groundwork for future research into this particular area.

To overcome this limitation I estimate two different analyses with variations in the start of time, or the period of risk.

In the first, I consider respondents who have lived in the same state since 2000, and make an assumption that if they lived in the same state from 2000 until the time of the NSFG interview, then they have lived in the same state since birth. I make this assumption based on the logic that even if the respondent has lived in a different state, any other states they have lived in may have similar state-level characteristics, including, state-level mandates for insurance coverage of infertility services. Therefore, in this first series of analyses any respondent who said that they have lived in the same state since 2000 is assumed to have lived in that state since birth. The hazard of risk for HSB for this first set of analyses is age 15 for women at risk of primary infertility, and the age of their first birth for women at risk of secondary infertility. For this specific analysis, century months of risk for respondents that have not lived in the same state since 2000 are removed from the analyses.

In the second set of analyses, I consider respondents who have lived in the same state since 2000 and only look at HSB events that have occurred from 2000 until the NSFG interview date. In this sample, I am making no assumptions that someone who lived in the same state since 2000 will have lived in that same state since birth. For these analyses the period of observation begins in 2000 and the hazard of risk begins at age 15 for women at risk of primary infertility and at the age of the first birth for women at risk of secondary infertility.

In each set of analyses I look at the state-level effects at the individual state level, and, as a combined effect of residing in any state with mandates to cover or offer-to-cover insurance for infertility services. The state-level mandates are time-varying and reflect the date which the mandate was established by each corresponding state. In regards to the individual state effects respondents are only observed living in 1 of the 15 states with insurance mandates, or living in a state without any mandates. Respondents are coded 1 for the state they live in, and 0 for the other states: this creates a set of 15 dummy state variables. The reference group is states without any insurance mandates. There are fifteen individual states that offer insurance mandates: Arkansas, Connecticut, Hawaii, Maryland, Massachusetts, Montana, New Jersey, New York, Ohio, Rhode Island, and West Virginia. In regards to living in any that that has mandates to cover, or offer-to-cover insurance for infertility services, I combine the fifteen states with mandates into one variable where respondents are coded 1 if the state they live in covers, or offers-to-cover insurance for infertility, otherwise 0 if they live in a state without any mandates for infertility insurance coverage. The reference group in this analysis is living in a state without any mandates for insurance coverage.

To fully capture the macro-level effect of state-level insurance mandates on HSB for infertility I need to control for additional factors that influence these outcomes for both primary and secondary infertile women. Controls include the social factors tested in the previous chapter: highest level of education, employment status and cumulative number of years of employment, relationship type and duration, and maternal age. I control for these variables to estimate if there are indeed any effects of residing in state with state-level mandates. Therefore, by controlling for these factors as well as the childhood sociodemographic and race/ethnicity variables I will be able to identify the effect, if any, residing in a state with infertility insurance mandates has on HSB.

Overall, to test the effects of residing in a state with state-level mandates that insurance programs cover or offer-to-cover infertility services, the above-mentioned analyses that include the controls, parity status, and either the individual state-level mandates or the effect of residing in any state with a mandate. As with all the other analyses in this dissertation, I run fully interactive models that stratify by parity status to test if the rates of HSB are significantly different for women at risk of primary infertility versus women at risk of secondary infertility.

Analytic Strategy

Event-history discrete-time hazard models are used to estimate the risk of seeking help to get pregnant or to prevent a miscarriage, or put another way, to estimate the rates of HSB for infertility. Because behaviors for seeking help to get pregnant or prevent miscarriage are measured monthly by the NSFG, the transition to HSB for infertility are conceptualized as discrete time units, rather than continuous time. Therefore, person-months are the unit of analysis. Although using person-months for the unit of analysis increases the sample size substantially, discrete-time methods are appropriate for these analyses for two reasons. The first is that discrete-time methods do not deflate the standard errors and subsequent tests for statistical significance are provided (Allison, 1982). Second, the probability of HSB for infertility within a given month is so small that the estimates provided through discrete-time methods would be very similar to estimates given from continuous methods (Axinn & Barber, 2001). I use a logistic regression model to predict if HSB did or did not occur for each respondent during the period of observation. I use the following logistic regression formula:

$$Ln[p/(1-p) = \alpha + \sum(\beta k)(Xk)$$

In this formula, *p* is the monthly probability of HSB for infertility and p/(1-p) is the monthly odds of HSB occurring. In the logit model, coefficients indicate the log-odds of HSB for infertility for a one unit change in the explanatory variables. I present the coefficients from the models as exponentiated log-odds, or odds ratios. This allows for interpretation of the coefficients as the monthly odds of HSB for infertility. Odds ratios greater than 1 indicate a positive effect, odds ratios less than 1 indicate a negative effect, and odds ratios equal to one indicate no effect. In the chapters that follow I identify and define the time-varying variables and control variables that are fixed at baseline, for each research question. To compare the rates of HSB for each of the three research questions, pairs of models are run separately by infertility status: primary or secondary.

Summary

In this chapter I introduce the NSFG data files and explain how the survey design that collects retrospective data on pregnancy and reproductive health histories, on educational, employment, and relationship dates, and state residence make using the NSFG an appropriate data source for this dissertation. I present the event-history analyses to test the effects of time-varying education, employment, relationship status, and maternal age effects on the HSB rates for women at risk of primary and secondary infertility. I outline how a logistic regression to test any lifetime effects of an STI is useful in understanding the associated risks HSB for infertility in the presence of an STI. Finally, I outline the unique approach using an event-history analysis in testing the effects of state-level mandates on HSB by parity status. Within each subsection for the substantive areas of this dissertation I address any limitations of the data or analyses. In the proceeding chapters I present the findings and results from the substantive research hypotheses.

Chapter 5

SOCIAL FACTORS AND HEALTH-SEEKING BEHAVIORS

In this chapter I present the effects of social factors on the risk of HSB for infertility by parity status. The time-varying social factors in these analyses include the highest level of educational attainment, employment status and cumulative years of employment, relationship type and relationship duration. Controls for these analyses include the respondent's race/ethnicity, childhood sociodemographic characteristics, and the respondent's age. Using discrete-time methods I test the effect of each of these four social factors on the rates of HSB for infertility. I begin by testing the effects of education, followed by employment, and finishing with relationship status. I chose to run the analyses in this order because of the traditional demographic transition into adulthood and childbearing after completing school, beginning employment, and finding a suitable partner (Miller, 2010; Anderson, Binder, & Krause, 2002). In each model I stratify by parity status and then test a fully interactive model to determine if the effects of the social factors on the risks of HSB vary by parity status. The presentation of the stratified models is indicated by columns type of infertility risk, either primary or secondary. Any significant effects from the interactive model comparing the risk for HSB by parity status are identified within each model.

Descriptive Statistics

Prior to discussing the results of the hazard models, I present the descriptive statistics from Table 5-1, which is a useful summary of the characteristics for the outcome measure, controls, and independent variables. The sample size for the social factors analyses is 11,210 female respondents aged 18 or older who have ever had sexual intercourse with a man. At the time of the NSFG survey interview, 21% of the respondents have ever used HSB for infertility. From this group, 7% reported HSB for issues related to primary infertility and 14% reported HSB for issues related to secondary infertility. In addition, at the time of NSFG interview, 42% of the entire sample was identified as nulliparous and 58% were identified as parous.

The means and standard deviations of the control variables in the social factors analyses provide an overview of the sociodemographics characteristics of the sample. The largest racial/ethnic group in the sample is non-Hispanic white women which make up 52% of the sample. Non-Hispanic black women make up 21% of the sample size and Hispanic women represent 22% of the sample size. Respondents that identify as some other, non-Hispanic race are only 5% of the sample. The racial/ethnic breakdown in this sample is representative of the racial/ethnic composition at a national level which is in line with the nationally representative structure of the NSFG survey design.

The childhood sociodemographic variables included in the analyses are useful as a proxy for socioeconomic status, but also provide information regarding the exposure of various levels of education, employment, and childbearing trends during the respondent's childhood. For example, there appears to be a balanced distribution of educational levels for the mother's of the respondents. Only 25%

of the mothers did not have a high school degree and 32% had a high school degree. At least 24% had some college experience and 19% of the mother's had a bachelor's degree. In addition, more than 70% of the mother's worked either full or part time during the respondent's childhood. The direct impact of these factors on predicting future educational or employment activities is beyond the scope of this dissertation but it provides a rudimentary understanding about the role of education and employment during the respondent's childhood. I include the age at which the mother of the respondent had her first child for two reasons. One, it is a useful tool at estimating socioeconomic characteristics for the mother and respondent, and two, it sheds light on what percentage of the sample had mothers who had children at advanced maternal ages. For this sample, only 8% of the mothers had their first baby at age 30 or older. This may be representative of the more social and demographic trends for fertility at the time of the respondents' childhood.

The final sets of descriptive statistics I want to discuss are the independent variables. This includes the respondent's highest level of education, employment status and cumulative years of employment, and relationship status. The means provided for these descriptive statistics are representative of the respondent's status at the time of the NSFG survey interview and provide a general understanding of the sociodemographic characteristic of the respondents in this sample.

In regards to educational attainment, at least 51% of the respondents have a high school degree or GED equivalent and 35% have less than a high school degree. 12% have a bachelor's degree and 2% have completed a graduate (i.e. Master's or PhD) degree. 63% of the sample has been working in full- or part-time work in the six months prior to the NSFG interview and the cumulative average number of years of full- or part-time employment has 13.4 years. The majority of the sample is single, which includes people who have never been married, divorced, or widowed. It also includes people who may report that they are in a relationship but they are not cohabiting and/or are not married with their partner. 47% of the sample is identified as being single at the time of the NSFG interview. In comparison, 35% of the sample is married and 18% of the sample is cohabiting. In terms of relationship duration for the people that are in a marital or cohabiting union, 11% have been with their partners for less than 1 year, 39% have been in a relationship for 1 to 3 years, 28% have been together for 3 to 5 years, and 22% report being in a relationship for 5 or more years.

Finally, the age distribution for this sample at the time of the NSGH interview includes 33% of female respondents age 15 to 19, 27% age 20 to 24, 19% age 25 to 29, 12% age 30-34, 7% age 35-39 and 2% age 40 to 45. The larger percentage of female respondents in the younger cohorts is a direct result of oversampling of these age groups by the NSFG survey design. In the section that follows I present the results from the event-history analyses testing the effects of the selected social factors (education, employment status and relationship status) on the risks of HSB for infertility by parity status.

Analytic Procedure

Of the 12,279 women that were interviewed by the NSFG between 2006 and 2010, 11,377 were asked questions regarding their HSB for infertility. Women who were younger than age 18 at the time of the interview, or women who reported that they had never had sex with a man, were not asked any of the infertility HSB. There were 902 women who were not asked the HSB questions. However, from this sample of 11,377 another 167 cases were removed because of missing values or data for the independent variables used on the analyses for the social factors, biological mechanisms, and contextual effects. The final sample size for all the analyses is 11,210 women which is approximately 92% of the original sample.

In these analyses I start the hazard for the risk of primary infertility at age 15 and the hazard for the risk of secondary infertility at the age of the female respondent at her first, live birth. I have two different hazards because women can only become at risk for secondary infertility after she has had at least one successful pregnancy. Therefore, it is necessary to begin measuring the risk once after this first live birth and after she can be identified as parous.

For primary infertility, the hazard begins at age 15 for two reasons. First, at least 60% of the sample reports having their first sexual intercourse with a man before age 18 and the youngest age being age 15. There were no reported first sexual intercourses younger than age 15 in this sample. Second, even though the risks for primary infertility are relatively low for women younger than age 18, starting the hazard at age 15 is a natural point in time to begin the period of risk for HSB for infertility, because with the onset of exposure to pregnancy, so begins the risk for infertility. The time-varying covariates included in this model pertain to time periods after the hazard begins for both primary and secondary infertility and controls are based on fixed, childhood characteristics.

In the models that follow, time is identified as the age of the first HSB for infertility and time has been parameterized as a quadratic function. The decision to parameterize the hazard as a quadratic function is based on the hazard function (Figure 5-1) and the Kaplan Meier (KM) (Figure 5-2) survival function. The shape of the hazard yields an upside down "U" shape where the risk for HSB increases and then decrease with age. The graph in Figure 5-1 shows the hazard function of age at HSB for infertility stratified by parity status: nulliparous or parous. The duration on the x-axis represents age in years beginning with age 15 and ending with age 45. The log-rank and Wilcoxon chi square statistics are statistically significant with a p-value of .0001 for both the KM estimator and the hazard function. This demonstrates that there are differences on the risk of HSB for a nulliparous and parous respondent. This is true even if the difference between these groups is more evident at the beginning or end of the survival curve.

Because this dissertation is looking at the effect of parity status on HSB for infertility, pairs of models were conducted separately for women at risk of primary infertility and women at risk of secondary infertility. Fully interactive models were conducted that interacted infertility risk with each predictor and control. A third column next to each pair of models indicates with an ‘X’ if the differences in the risks of HSB are significant for women at risk of primary infertility compared to women at risk of secondary infertility at the .05 level.

As I present the findings from the hazard models estimating the effects of social factors on the risks of HSB for infertility, I begin by discussing the results from the models looking at the control variables only. These findings are presented in Table 5-2 together with the variables for educational attainment. I will discuss the effects of the social factors on the risk of HSB for primary infertility first, followed by the results for the risk of HSB for secondary infertility.

Using women aged 15 to 19 as the reference age cohort, the rates of HSB for women aged 30 to 34, who are at risk for primary infertility, are 299% (3.99-1.00 = 299%) more than the rates of HSB for the reference group. The next highest rates of HSB for women at risk of primary infertility are women aged 25 to 29 who are 202% (3.02-1.00 = 202%) more likely than 15 to 19 year olds to be at risk of HSB for infertility. Finally, women aged 35 to 39 are 127% (2.27 – 1.00 = 127%) more likely to be at risk for HSB for primary infertility compared to women aged 15 to 19. Finally, women age 20 to 24 are 171% (2.71 – 1.00 = 271%) more likely than 15 to 19 year-olds to engage in HSB and women age 40 45 are 88% (1.88 – 1.00 = 88%) more likely to be at risk of HSB for infertility compared to women aged 15 to 19. The unique finding from the age cohort controls for women at risk of primary infertility is the rates of HSB among women aged 40 to 45 who are only 88% higher than women aged 15 to 19. In addition, women aged 40 to 45 have the lowest rates of HSB (88%) compared to the reference group among all the other age cohorts. For example, the rates of HSB for the age cohorts 20 to 24 is 171%, for 25 to 29 is 102%, for 30 to 34 is 299%, and 127% for women aged 35 to 39, compared to the reference group.

For women at risk of secondary infertility, the rates of HSB among each age cohort are higher than the rates of HSB for women aged 15 to 19. However, and unlike the trends found among women at risk of primary infertility, that rates of HSB for women at risk for secondary infertility who are aged 40 to 45 are 96% greater than women aged 15 to 19; whereas for women at risk of primary infertility the risk is 88% greater than women aged 15 to 19. The differences in the effects of age on the risks of HSB for both primary and secondary infertility are significant at the .05 level. In the later chapter on biological mechanisms I test specifically for the effect of maternal age, but to capture the effects of the selected social factors, I control for age. The other control measures included in these analyses were not significant in estimating the risks of HSB for either primary or secondary infertility.

In models 3 and 4 of Table 5-2 I examine the effect of educational attainment on the risks of HSB for infertility by parity status. My overarching hypothesis is that with more education the higher the rates of HSB for infertility. More specifically, I hypothesize that with more education, women at risk of primary infertility will have higher rates of HSB compared to women at risk of secondary infertility with similar levels of education. Pairs of models were run that stratify by parity status. Model 3 are the results of the effects of education on the rates of HSB for women at risk of primary infertility and Model 4 are the effects of education on HSB for infertility for women at risk of secondary infertility.

The results from Model 3 show that the rates of HSB for respondents at risk of primary infertility increase with each additional degree of education completed, when compared to the reference group (no high school/GED degree). For example, the rates of HSB for nulliparous respondents with a high school degree are 55% (1.55 – 1.00 = 55%) greater than the rates for women with no high school/GED degree. HSB rates for respondents with a bachelor's degree are 85% greater than the reference groups, and women at risk of primary infertility with a graduate degree are more than 190% more likely to be at risk of HSB for infertility compared to women with less than a high school degree. As expected, with more education, the rates of HSB increase, significantly for respondents with a bachelors ($p<.01$) or graduate degree ($p<.05$). This relationship may be explained by the fact that educational attainment is an enabling factor that can both delay the transition to childbearing for women, but is also provides access to certain resources or social networks that makes pursuing HSB for infertility more likely.

In Model 4 I look at the effects of education on HSB for respondents at risk of secondary infertility. In comparison to women with less than a high school degree/GED equivalent, the rates of HSB increase with each educational degree higher. For example, women at risk of secondary infertility who have at least a high school diploma are 69% more likely to engage in HSB for infertility compared to women with less than a high school diploma. For women with a bachelor's degree the rates of HSB are 197% greater than the reference group and for women with a graduate degree the rates are 234% greater than women with less than a high school degree. The effects of educational attainment on the rates of HSB for women at risk of secondary infertility are all significant at the p<.001. Contrary to my hypotheses that the effects of education on the rates of HSB for infertility would be stronger for women at risk of primary infertility compared to women at risk for secondary infertility, there was no significant difference observed in the rates of HSB by parity status.

In Table 5-3 I present the results for two types of employment-status effects on the risk of HSB for infertility, based on parity status. The first employment effect is being employed in either full- or part-time employment in the month prior to the risk of HSB for infertility. The second employment effect is cumulative years of full- or part-time employment in the month prior to the risk of HSB for infertility. My hypothesis regarding employment status is that being employed in either full- or part-time employment as well as the cumulative number of years of employment will increase the rates of HSB for infertility for both nulliparous and parous woman. More specifically, I hypothesize that the effects of employment on the rates of HSB will be stronger for women at risk of primary infertility compared to women at risk of secondary infertility.

In Model 1 of Table 5-3 I present the results of employment status on the rates of HSB for women at risk of primary infertility. The rates of HSB for infertility for women who were employed in paid labor for either full- or part-time work in the month prior to the risk of HSB are 180% greater than the rates of HSB for unemployed women, or women working in unpaid labor. Put another way, the risks of HSB for primary infertility are 180% greater than employed women (full or part time employment) compared to the rates of HSB for women who are unemployed or working in unpaid labor. This is significant at the .001 level. However, the effect of cumulative years of employment did not have a significant effect on the rates of HSB for women at risk of primary infertility. The higher rates of HSB for employed women compared to unemployed women is likely due the enabling aspects of employment that provide financial resources and benefits to a woman, influencing her HSB for infertility.

Model 2 in Table 5-3 presents the results of employment for women who are at risk of HSB for secondary infertility. The first significant finding of employment status in the rates of HSB for women at risk of secondary infertility is being employed in either full or part time employment. The rates of HSB women who are employed in full- or part-time employment are 168% greater than the rates for unemployed women. In addition, the rates of HSB for women at risk of secondary employment increase by 11% for each year of employment. Put another way, for each year that a woman was employed in full- or part-time employment, her risks of HSB for secondary infertility increase by 11%.

The interactive models (not shown here, but identified with an 'X' in the model for any significant differences; $p<.05$) comparing the effects of employment on the rates of HSB for primary versus secondary infertility suggest that there is a significant difference in the rates of HSB for infertility for women at risk of primary infertility compared to women at risk for secondary infertility. For example, cumulative years of employment results in significant differences in the rates of HSB for women who are at risk of primary infertility compared to women who are at risk of secondary infertility; this is significant at $p<.05$. It is possible that the significant difference in the rates of HSB by parity status reflects the experience of the parous woman's exit and re-entry to the workforce from their first childbirth, and their willingness to postpone career aspirations to meet their fertility expectations, or, they have access to resources, financially or emotional, in the workplace environment that would promote HSB for infertility.

In Table 5-4 I control for relationship type and test the effects of relationship duration on the rates of HSB in two distinct models. In one model, I look at the effects of relationship duration for women who are at risk of primary infertility, and only for women who are married or in a cohabiting relationship – with single women as the reference group. In the second model, I look at the effects of relationship duration for women at risk of HSB for secondary infertility, and only for women who are married or in a cohabiting relationship – again, single women are the reference group. Unique to the models testing the effects of relationship duration and type, I do not compare the rates of HSB by parity status, but rather, I look at the different effects of relationship type among women at risk of either type of infertility. I do not compare rates by parity status for these models because doing so would reduce the number of observations in each category and any significant effects would be biased towards those low numbers. By approaching the analyses in this manner (looking at effects among groups of women by infertility risk) I am still able to distinguish the effects, if any, relationship duration has on the rates of HSB, specific to parity type.

In Model 1 of Table 5-4, I present the findings of the effects of relationship duration, for women who are married and are at risk of primary infertility. The coefficients presented in Model 1 of Table 5-4 come from the analyses that controls for relationship type and uses single women as the reference group. In a series of analyses (not shown here) I compare the effects of relationship duration by leaving out one of the four duration categories. For example, I use married for 0 – 1 year as a reference for one set of analyses, followed by married for 1 to 3 years as a reference, then married for 3 to 5 years as a reference, and finally, married for 5 or more years as a reference. Any significant effects between the different relationship durations are identified in Model 1 of Table 5-4 with a line between relationship durations and an asterisk indicating a significant difference at the .05 level. This series of analyses (i.e. leaving out one duration period for each model) is repeated for women who are cohabiting and are at risk of primary infertility, as well as the models for women who are married or cohabiting and are at risk of secondary infertility.

The results from Table 5-4, Model 1 indicate that among married women at risk of primary infertility, the highest rates of HSB for infertility are observed among women married for 3 to 5 years which is 147%% greater than single women. The next highest rate of HSB is among women who have been married for 1 to 3 years which is 123% greater than single women. Women at risk of primary infertility who have been married for 5 or more years have rates of HSB that are 103% greater than single women, and women married for less than 1 year have rates of HSB that are 74% greater than single women. These findings suggest that the effect of relationship duration increase the rates of HSB during the earlier years of a marital union, and that after 5 or more years of marriage, there is a slight lower rate of HSB compared to women married between 1 to 5 years, but this is still higher than the rates of HSB for single women.

The significant differences in relationship duration are observed among women at risk of primary infertility who have been married for less then 1 year compared to women married for 1 to 3 years. In this comparison, the higher rates of HSB among women married for 1 to 3 years is significantly greater than the rates of HSB for women married for less than 1 year. Likewise, the rates of HSB for women married for 3 to 5 years who are at risk of primary infertility are significantly greater than the rates of HSB for women married for less than 1 year. These significant comparisons by relationship duration suggest that there is an effect of relationship duration during the initial, or earlier years of the marital union.

Also in Model 1 of Table 5-4 I present the findings from the analyses testing the effects of duration for women in cohabiting unions which that the duration of a cohabiting relationship on the rates of HSB are significantly different from the rates of single women, but there are no significant differences between the different duration periods among this group of cohabiting women at risk of primary infertility.

In Table 5-5 I present the results from the analyses that control for relationship type and test the effects of relationship duration on the rates of HSB for women at risk of secondary infertility, controlling for relationship type and using single women as the reference group. In Model 1 of Table 5-5 I look at the effects of marriage duration on the rates of HSB for women at risk of secondary infertility. Women at risk of secondary infertility, who have been married for less then 1 year have HSB rates that are 164% greater than single women. The rates of HSB for women who have been married for 1 to 3 years is 196% greater than single women, and is 119% greater for women married for 3 to 5 years. The lowest rates of HSB compared to single women is observed among women at risk of secondary infertility who have been married for more than 5 years – their rates of HSB are 84% greater than single women. The effects of relationship duration for women who are married and at risk of secondary infertility are significant in predicting HSB for infertility, however, the only significant differences observed between relationship durations is between women married for 1 to 3 years and women married for 3 to 5 years. The effect of duration for women married for 1 to 3 years is significantly greater than the effect of duration for women married for 3 to 5 years. There were no significant effects of the duration on the rates of HSB for cohabiting women who are at risk of secondary infertility, nor were there any significant differences between the different lengths of relationship duration for women in cohabiting relationships.

In Table 5-6 I rearrange the coefficients from the analyses in Tables 5-4 and 5-5 to examine if, controlling for relationship duration, there are any significant effects on the rates of HSB by relationship type, among women at risk of primary infertility, or, among women at risk of secondary infertility. In Table 5-6 I do not include any control measures and only present the results for relationship type effects on HSB for infertility. The three relationship types I include are married, cohabiting, or single. The reference group for these analyses is single women. A woman can only be observed in one of these relationship types at the time of risk for HSB. I hypothesized that married women, more than cohabiting or single women, would have the highest rates of HSB for infertility.

In Model 1 of Table 5-6 I present the coefficients for the effects of relationship type for women at risk of primary infertility on the rates of HSB. It appears that being married and cohabiting increase the rates of HSB, compared to single women, but the only significant difference by relationship status is observed between women who have been married or cohabiting for 3 to 5 years. In this circumstance, the rates of HSB for women at risk of primary infertility are significantly higher for married women than cohabiting women. Model 2 of Table

5-6 is the coefficients testing the effects of relationship duration rearranged to test the effects of relationship type for women at risk of secondary infertility. The results from these analyses suggest that for women at risk of secondary infertility, being married, versus being single, significantly increases the rates of HSB for infertility. There were no significant effects of being in a cohabiting union on the rates of HSB, nor were there are any significant difference between relationship type for women who are married or cohabiting and are at risk of secondary infertility.

A final set of models presented in Table 5-7 tests the effects of all the social factors on the rates of HSB for infertility. In Model 1 I test the effects of education, employment, and relationship status on the rates of HSB for women at risk of primary infertility. In Model 2 I test the effects of education, employment, and relationship status on the rates of HSB for women at risk of secondary infertility. This full model, testing the effects of all the social factors on the rates of HSB, was estimated to determine if the outcomes for each of the theoretical concepts would persist in the presence of the other social factors. The results from Model 1 indicate that the rates of HSB for women at risk of primary infertility increase with each higher degree of education, the rates of HSB are higher if she is employed in full or part time paid employment, and the rates of HSB increase the longer she has been in a relationship, and if she is married versus being single or cohabiting. These outcomes are similar the outcomes observed when I tested the individual effects of the social factors on rates of HSB for women at risk of primary infertility.

In Model 2 I estimate the effects of the combined social factors for women at risk of secondary infertility. The outcomes from this full model suggest that the rates of HSB are higher among women at risk of secondary infertility with more education, those who are employed, the longer she has been in a relationship, and if she is married. These outcomes are similar to the outcomes when I tested each individual social factor effect on the rates of HSB for women at risk of secondary infertility.

Additionally, the rates of HSB by parity status in the presence of the combined social factors reflect the outcomes from each individual model. For example, women at risk of primary infertility are 7% less likely to engage in HSB for infertility with each cumulative year of employment, whereas women at risk of secondary infertility are 5% more likely to engage in HSB for infertility. The outcomes from the models in Table 5-7 demonstrate that in the presence of all the social factor effects, the rates of HSB for infertility vary among women at risk of primary or secondary infertility. Finally, in a separate series of models, not shown here, I test the individual effect of parity status in a combined, full model to determine which group of women, those at risk of primary infertility or those at risk of secondary infertility, have overall higher risks of HSB for infertility. The results from these analyses suggest that for women at risk of primary infertility, the overall risk of HSB are 38% higher than women at risk of secondary infertility. These findings support my overall hypothesis that the rates of HSB for infertility significantly vary by parity status.

A preliminary interpretation of these outcomes suggests that in spite of the growing number of children born into cohabiting unions, the enabling resources available through marital unions and marriages that have been together longer are more prominent in predicting the rates of HSB for primary and secondary infertility among married woman more than single or cohabiting women. It is possible that general social expectations and norms regarding childbearing within a marital union influence the decisions to seek treatment if infertility complications arise.

Summary

In this chapter I presented the findings from models testing the effects of educational attainment, employment, and relationship status on the rates of HSB for infertility by infertility status. In regards to educational attainment, I hypothesized that with each higher level of education, women at risk of primary infertility would have higher rates of HSB than woman at risk of secondary infertility. Even though there were significant effects of education on the rates of HSB within each group of infertility risk (i.e. primary infertility or secondary infertility) there were no significant differences in the effects of HSB by parity status.

I hypothesized that there would be significantly higher rates of HSB for women at risk of primary infertility who were employed, versus being unemployed, but the findings indicated that there are no significant differences in the rates of HSB for infertility However, there were significant effects by parity status on the rates of HSB based on the cumulative number of years of employment. Specifically, women at risk of secondary infertility had significantly higher rates of HSB for infertility compared to the rates of HSB for women at risk of primary infertility.

In regards to relationship status, the positive and significant effects on the rates of HSB for women at risk of primary infertility were observed among women married for less than 1 year, compared to women married for 1 to 3 years, as well as women married for 1 to 3 years, to women married for 3 to 5 years. There were no significant differences in the duration of a cohabiting relationship on the rates of HSB. However, being married for 3 to 5 years, significantly increases the rates of HSB compared to single women and this outcome is significantly greater than the rates of HSB for cohabiting women who have been in a relationship for the same 3 to 5 year time frame. The only observed significant differences by relationship duration or type for women at risk of secondary infertility was presented among married women who have been in a relationship for 1 to 3 years compared to those in a relationship for 3 to 5 years. There were no significant differences by relationship type in the rates of HSB for women at risk of secondary infertility.

In the next chapter I present the findings from the analyses testing the effects of biological mechanisms including maternal age and any lifetime diagnosis of STI on the rates of HSB for infertility by parity status.

Table 5-1: Means and Standard Deviations for the Outcome Meaures, Independent Variables and Controls for the Social Factors Hypotheses

	Mean	Std. Dev.	Minimum	Maximum	N
Ever use HSB for infertility (at time of interview)	0.11	0.31	0	1	11210
HSB for Primary Infertility	0.33	0.25	0	1	411
HSB for Secondary Infertility	0.67	0.34	0	1	832
Parity Status (at time of interview)					
Nulliparous	0.42	0.49	0	1	11210
Parous	0.58	0.49	0	1	11210
Educational Attainment					
No High School Degree/GED	0.35	0.48	0	1	11210
High School Degree	0.51	0.50	0	1	11210
Bachelor's Degree	0.12	0.33	0	1	11210
Graduate Degree (MA or PhD)	0.02	0.13	0	1	11210
Employment Status					
Full- or Part-Time Employment	0.63	0.48	0	1	11210
Unemployed/Working Unpaid Labor	0.37	0.29	0	1	11210
Cumulative Years of Employment					
Full- or Part-Time Years of Employment	13.4	2.71	1	20	11210
Relationship Type					
Married	0.35	0.17	0	1	11210
Cohabiting	0.18	0.25	0	1	11210
Single	0.47	0.23	0	1	11210
Relationship Duration					
0 to 1 years	0.11	0.12	0	1	654
1 to 3 years	0.39	0.15	0	1	2317
3 to 5 years	0.28	0.11	0	1	1664
5 or more years	0.22	0.12	0	1	1307

Source: National Survey of Family Growth, 2006-2010 Continuous Data File

Table 5-1 ***(continued):*** **Means and Standard Deviations for the Outcome Meaures, Independent Variables and Controls for the Social Factors Hypotheses**

	Mean	Std. Dev.	Minimum	Maximum	N
Age Cohorts					
Age 15-19	0.33	0.47	0	1	11210
Age 20-24	0.27	0.44	0	1	11210
Age 25-29	0.19	0.39	0	1	11210
Age 30-34	0.12	0.33	0	1	11210
Age 35-39	0.07	0.25	0	1	11210
Age 40-45	0.02	0.15	0	1	11210
Race/Ethnicity					
Non-Hispanic White	0.52	0.50	0	1	11210
Non-Hispanic Black	0.21	0.41	0	1	11210
Hispanic	0.22	0.41	0	1	11210
Non-Hispanic Other	0.05	0.23	0	1	11210
Childhood Sociodemographics					
Biological parents married at birth	0.78	0.42	0	1	11210
Mother's Education					
No High School Diploma/GED	0.25	0.44	0	1	11210
High School Diploma/GED	0.32	0.47	0	1	11210
Two Years of College	0.24	0.42	0	1	11210
Bachelor's Degree	0.19	0.39	0	1	11210
Mother worked full or part time	0.72	0.45	0	1	11210
Mother's age at first baby					
Age 19 or younger	0.37	0.48	0	1	11210
Age 20 to 24	0.37	0.48	0	1	11210
Age 25 to 30	0.18	0.38	0	1	11210
Age 30 or older	0.08	0.27	0	1	11210

Source: National Survey of Family Growth, 2006-2010 Continuous Data File

Table 5-2: Effects of Educational Attainment on the Rates of Health-Seeking Behaviors for Infertility

Model	1	2		3	4	
Type of Infertility Risk	Primary	Secondary		Primary	Secondary	
Educational Attainment[1] (time-varying)						
High School Degree (GED Equivalent)				1.55*	1.69***	
Bachelors Degree				1.85*	2.97***	
Graduate Degree (Masters or PhD)				2.90***	3.34***	
Time-Invariant Controls						
Age Cohorts[2]						
20-24	2.71***	1.81***	X	2.36***	1.79***	
25-29	3.02***	1.98***	X	3.14***	1.96***	X
30-34	3.99***	1.81***	X	3.97***	1.82***	X
35-39	2.27***	1.36***	X	2.37***	1.37***	X
40-45	1.88***	1.96***	X	1.38***	1.02***	X
Race/Ethnicity[3]						
Non-Hispanic Black	0.49	0.50		0.63*	0.49*	
Hispanic	0.54	0.54		0.91	0.58	
Non-Hispanic Other	0.77	0.80		0.63	0.71	
Childhood Sociodemographics						
Biological parents married at birth[4]	1.08	1.15		0.74	1.01	
Mother's Education[5]						
High School/GED	1.01	1.02		1.00	1.04	
Two Years College	1.14	1.13		1.12	1.01	
Bachelor's Degree	1.49	1.48		0.97	1.22	
Mother worked full or part time[6]	1.05	1.01		0.88	1.05	
Mother's age at first baby[7]						
Age 20 to 24	0.97	0.99		0.77	0.90	
Age 25 to 29	0.94	0.97		0.71	0.84	
Age 30 or older	0.67	0.69		0.36	0.62	
Person Months	1096796	868559		1096796	868559	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is less than a high school degree; [2] Reference group is age 15 to 19; [3] Reference group is non-Hispanic white;
[4] Reference group is parents not married at birth; [5] Reference group is less than high school degree;
[6] Reference group is not working; [7] Reference group is age 19 or younger

Table 5-3: Effects of Employment Status on the Rates of Health-Seeking Behaviors for Infertility

Model	1	2	
Type of Infertility Risk	Primary	Secondary	
Employment Status[1] (time-varying)			
Full or part time employmenet	2.80***	2.68***	
Cumulative years of full/part time employment	0.97	1.11***	X
Time-Invariant Controls			
Age Cohorts[2]			
20-24	2.04***	1.74*	
25-29	2.58***	1.88*	X
30-34	2.39***	1.70*	X
35-39	1.87***	1.31*	X
40-45	1.08***	1.85*	X
Race/Ethnicity[3]			
Non-Hispanic Black	0.67**	0.55**	
Hispanic	0.92	0.66**	
Non-Hispanic Other	0.78	0.80	
Childhood Sociodemographics			
Biological parents married at birth[4]	0.82	1.05	
Mother's Education[5]			
High School/GED	1.15	0.82	
Two Years College	1.10	0.91	
Bachelor's Degree	1.16	1.14	
Mother worked full or part time[6]	0.85	0.99	
Mother's age at first baby[7]			
Age 20 to 24	0.80	0.92	
Age 25 to 29	0.77	0.85	
Age 30 or older	0.40	0.63	
Person Months	1096316	868176	

Coefficients are odds ratios

*p<.05, **p<.01, ***p<.001

'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is unemployed/working in unpaid labor; [2] Reference group is age 15 to 19;
[3] Reference group is non-Hispanic white; [4] Reference group is parents not married at birth;
[5] Reference group is less than high school degree; [6] Reference group is not working;
[7] Reference group is age 19 or younger

Table 5-4: Effects of Relationship Duration on the Rates of Health-Seeking Behaviors for Women at Risk of Primary Infertility

	Model 1		
Within Marital Relationships[1]			
0 to 1 years	1.74***		
1 to 3 years	2.23***	*	*
3 to 5 years	2.47***		
5 or more years	2.03***		
Within Cohabiting Relationships[1]			
0 to 1 years	1.22***		
1 to 3 years	1.36***		
3 to 5 years	1.93***		
5 or more years	1.07***		
Person Months	965,720		

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001

[1]Reference is single/not in a relationship; [2]Reference is ages 15 to 19;
[3]Reference is non-Hispanic white; [4]Reference is not married at birth
[5]Reference is no high school degree; [6]Reference is unemployed
[7]Reference is age 19 or younger

Table 5-4 *(continued)* : Effects of Relationship Duration on the Rates of Health-Seeking Behaviors for Women at Risk of Primary Infertility

	Model 1
Time-Invariant Controls	
Age Cohorts[2]	
20-24	2.23***
25-29	3.25***
30-34	4.41***
35-39	3.21***
40-45	2.17***
Race/Ethnicity[3]	
Non-Hispanic Black	0.24
Hispanic	0.94
Non-Hispanic Other	0.85
Childhood Sociodemographics	
Biological parents married at birth[4]	0.69
Mother's Education & Employment Status[5]	
High School/GED	1.10
Two Years College	1.15
Bachelor's Degree	1.14
Mother worked full or part time[6]	0.90
Mother's Age at First Baby[7]	
Age 20 to 24	0.89
Age 25 to 29	0.88
Age 30 or older	0.48
Person Months	965,720

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001

[1]Reference is single/not in a relationship; [2]Reference is ages 15 to 19;
[3]Reference is non-Hispanic white; [4]Reference is not married at birth
[5]Reference is no high school degree; [6]Reference is unemployed
[7]Reference is age 19 or younger

Table 5-5: Effects of Relationship Duration on the Rates of Health-Seeking Behaviors for Women at Risk of Secondary Infertility

	Model 1	
Within Marital Relationships[1]		
0 to 1 years	2.64***	
1 to 3 years	2.96***	*
3 to 5 years	2.19***	
5 or more years	1.84***	
Within Cohabiting Relationships[1]		
0 to 1 years	1.54	
1 to 3 years	1.94	
3 to 5 years	1.26	
5 or more years	0.93	
Person Months	418,753	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001

[1]Reference is single/not in a relationship; [2]Reference is ages 15 to 19;
[3]Reference is non-Hispanic white; [4]Reference is not married at birth
[5]Reference is no high school degree; [6]Reference is unemployed
[7]Reference is age 19 or younger

T**able 5-5** ***(continued)*** *:* Effects of Relationship Duration on the Rates of Health-Seeking Behaviors for Women at Risk of Secondary Infertility

	Model 1
Time-Invariant Controls	
Age Cohorts[2]	
20-24	2.17**
25-29	3.25**
30-34	3.51**
35-39	3.15**
40-45	1.910
Race/Ethnicity[3]	
Non-Hispanic Black	0.62**
Hispanic	0.56**
Non-Hispanic Other	0.74
Childhood Sociodemographics	
Biological parents married at birth[4]	0.99
Mother's Education & Employment Status[5]	
High School/GED	0.92
Two Years College	1.14
Bachelor's Degree	1.48
Mother worked full or part time[6]	1.07
Mother's Age at First Baby[7]	
Age 20 to 24	0.94
Age 25 to 29	0.91
Age 30 or older	0.66
Person Months	418,753

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001

[1]Reference is single/not in a relationship; [2]Reference is ages 15 to 19;
[3]Reference is non-Hispanic white; [4]Reference is not married at birth
[5]Reference is no high school degree; [6]Reference is unemployed
[7]Reference is age 19 or younger

Table 5-6: Effects of Relationship Type on the Rates of Health-Seeking Behaviors for Infertility, Controlling for Duration

Model 1: Risk of HSB for Primary Infertility

Relationship Type	Married	Cohabiting	
Duration[1]			
0 to 1 years	1.74***	1.22***	
1 to 3 years	2.23***	1.36***	
3 to 5 years	2.47***	1.93***	X
5 or more years	2.03***	1.07***	

Model 2: Risk of HSB for Secondary Infertility

Relationship Type	Married	Cohabiting
Duration[1]		
0 to 1 years	2.64***	1.54
1 to 3years	2.96***	1.94
3 to 5 years	2.19***	1.26
5 or more years	1.84***	0.93

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by Relationship Type

[1]Reference is single/not in a relationship

Table 5-7: Effects of all Social Factors on the Rates of Health-Seeking Behaviors for Infertility

Model	1	2	
Type of Infertility Risk	Primary	Secondary	
Educational Attainment[1] (time-varying)			
High School Degree (GED Equivalent)	1.57*	1.18**	
Bachelors Degree	1.99*	2.49**	
Graduate Degree (Masters or PhD)	3.92**	2.54**	
Employment Status[2] (time-varying)			
Full or part time employmenet	2.86***	2.46***	
Cumulative years of full/part time employment	0.93	1.05**	X
Within Marital Relationships[3]			
0 to 1 years	1.84**	2.53**	
1 to 3 years	2.41**	2.74**	
3 to 5 years	2.50**	2.01**	
5 or more years	1.75**	1.90**	
Within Cohabiting Relationships[3]			
0 to 1 years	1.06**	1.44	
1 to 3 years	1.26**	1.86	
3 to 5 years	1.36**	1.34	
5 or more years	1.02**	1.05	
Person Months	1096316	868176	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is less than a high school degree;
[2] Reference group is unemployed/working in unpaid labor;
[3] Reference is single/not in a relationship; [4] Reference is age 15 to 19;
[5] Reference is non-hispanic white;
[6] Reference group is parents not married at birth;
[7] Reference group is less than high school degree;
[8] Reference group is not working; [9] Reference group is age 19 or younger

Table 5-7 *(continued):* Effects of all Social Factors on the Rates of Health-Seeking Behaviors for Infertility

Model	1	2	
Type of Infertility Risk	Primary	Secondary	
Age Cohorts[4]			
20-24	1.43	1.89	
25-29	1.76**	1.07	X
30-34	2.28**	1.89	X
35-39	1.66	1.41	X
40-45	1.10	1.09	
Race/Ethnicity[5]			
Non-Hispanic Black	0.57	0.67*	
Hispanic	0.41	0.69*	
Non-Hispanic Other	0.27	0.77	
Childhood Sociodemographics			
Biological parents married at birth[6]	0.70	0.96	
Mother's Education[7]			
High School/GED	1.06	0.84	
Two Years College	1.13	0.94	
Bachelor's Degree	1.13	1.19	
Mother worked full or part time[8]	0.89	1.01	
Mother's age at first baby[9]			
Age 20 to 24	0.87	0.89	
Age 25 to 29	0.87	0.84	
Age 30 or older	0.47	0.62	
Person Months	1096316	868176	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is less than a high school degree;
[2] Reference group is unemployed/working in unpaid labor;
[3] Reference is single/not in a relationship; [4] Reference is age 15 to 19;
[5] Reference is non-hispanic white;
[6] Reference group is parents not married at birth;
[7] Reference group is less than high school degree;
[8] Reference group is not working; [9] Reference group is age 19 or younger

Figure 5-1: Hazard function of age when at risk for HSB for infertility; stratified by parity status. Blue line = nulliparous (at risk for primary infertility). Red line = parous (at risk for secondary infertility).

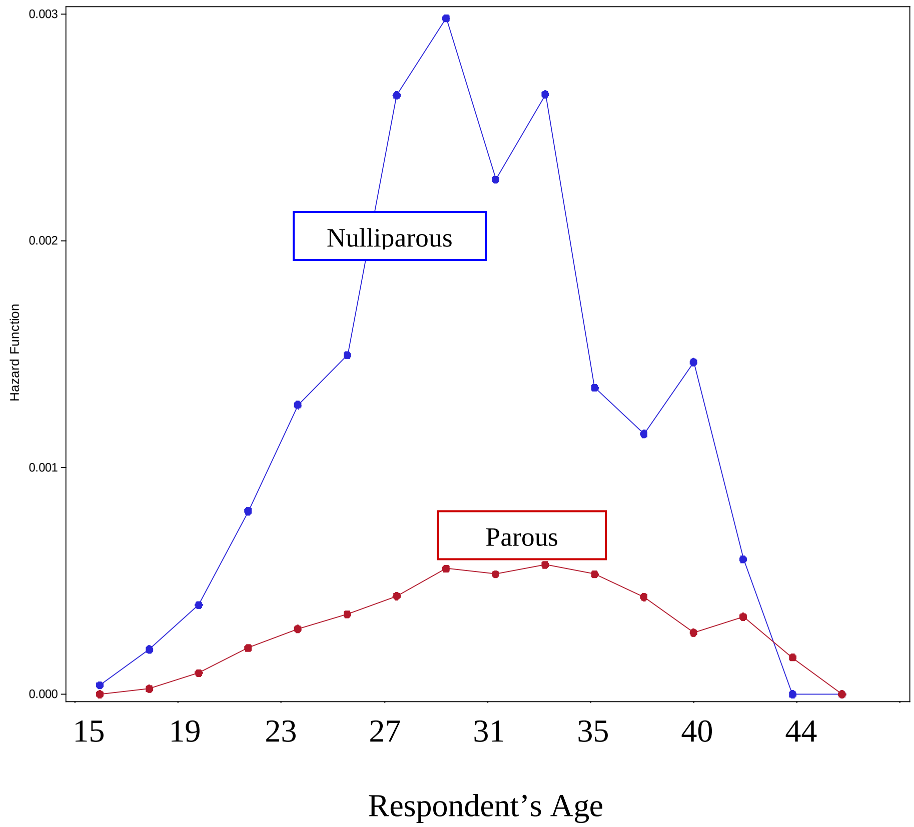
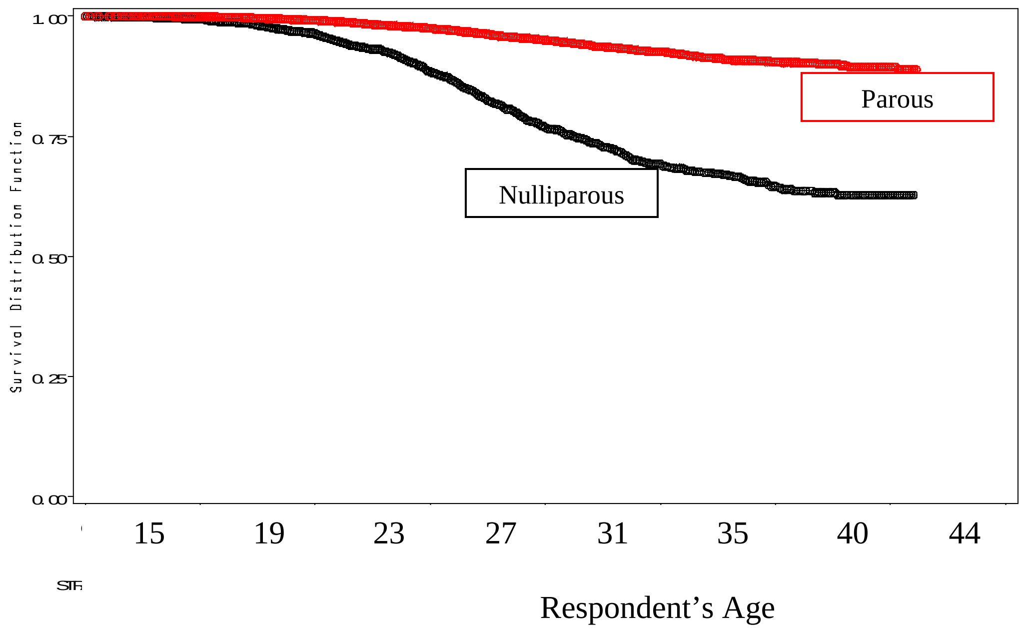


Figure 5-2: Kaplan Meier curve estimating the number of female respondents at risk for HSB for infertility, stratified by parity status: nulliparous (at risk for primary infertility = black line) and parous (at risk for secondary infertility = red line).



Chapter 6

BIOLOGICAL MECHANISMS AND HEALTH-SEEKING BEHAVIORS

In this chapter I present the results testing the effects of biological mechanisms on the rates of HSB for women at risk of primary or secondary infertility. There are two unique analyses tested in this chapter. In the first, I look at the effects of maternal age on the rates of HSB by parity status. This is conducted using an event-history analysis. In the second, I consider the effects of any lifetime STI diagnosis on the odds of HSB for infertility by parity status. The analyses testing STI effects are tested using a logistic regression. In the sections that follow, I present the findings from these analyses with a brief discussion on some of the more significant outcomes. A more detailed discussion is provided for these outcomes in Chapter Eight. Prior to presenting the outcomes for the effects of maternal age and any lifetime diagnosis on the rates of HSB, I briefly address some of the descriptive statistics for the variables used in the analyses.

Descriptive Statistics

When testing the effects of biological mechanisms on HSB for infertility I control for parity status, race/ethnicity, childhood sociodemographic characteristics, and sociodemographic characteristics of the respondent that are time-varying for the models on maternal age, or, are based on the respondent’s status at the time of the interview when testing the effects of STI on the odds of HSB. I include time-varying controls in the models on maternal age because the analytic procedure is an event-history analysis and time-varying covariates are an appropriate control. However, in the models testing the effects of lifetime STI on HSB, the analytic procedure is a logistic regression where the observed outcomes are measured at the time of the NSFG interview. Therefore, the controls in these STI models reflect the respondent's status at the time of the NSFG interview.

The descriptive statistics for the biological mechanisms address the variables that are relative to the analyses on maternal age and STI diagnosis. In the previous chapter on social factors, the means and standard deviations for the other control variables have been thoroughly discussed. Beginning with the variables for age, the mean age of the female respondents was 29.6 years. Of the 4335 respondents who were married, the mean age is 33.6. For the 1825 cohabiting respondents, the mean age is 28.4, and for the 5050 single respondents, the mean age is 25.2 years. In regards to parity, the mean age for women at their first birth, if they had a live first birth is 23.2 and 27.6 for a second birth. If a nulliparous woman reported any HSB, her mean age when she is at risk for primary infertility is 31.6. If a parous woman reported any HSB, her mean age when she's at risk for secondary infertility is 34.4.

In this sample of 11,210 women 12% report that in their lifetime they have been diagnosed with at least one of 5 different STI. For these women that have been diagnosed with any STI, 9% of the diagnoses were for chlamydia, 7% for gonorrhea, 4% for genital warts, 4% for herpes, and finally 2% for syphilis. These are useful descriptive statistics because they provide a general demographic picture of the women in this sample as well as demonstrate that the NSFG survey design, and the subsequent sample population, is representative of the greater US population. In the next section I present the results for the event-history analyses testing the effects of maternal age on the rates of HSB for women at risk of primary and secondary infertility.

Analytic Procedure for Maternal Age

Two different measures of maternal age are included in these analyses: age as a series of single-year dummy variables and 5-year age cohorts. Time-varying controls for these analyses include the respondent's educational attainment, employment status, and marital status. Time-invariant baseline measures that I control for include the respondent's race/ethnicity and childhood sociodemographic characteristics. Pairs of models are presented that stratify and compare the effects of maternal age on the rates of infertility by parity status. Any significant differences ($p<.05$) between the effects of maternal age for women at risk of primary infertility versus women at risk of secondary infertility are identified with an 'X' in each model.

The first set of analyses tests the effects of age as a series of single-year dummies. The reference group is women aged 18 or younger. Ages 15, 16, 17, and 18 are grouped together, as are ages 44 and 45. The decision to combine these ages together is based on the very few HSB events occurring at the youngest and oldest ages. In separate models (not shown here) the parameter estimates for the single-year dummies for age 15, 16, 17, 18, 44, and 45 had very large standard errors. Therefore, I combined the ages together.

In Model 1 of Table 6-2, the effects of the single-year age dummies are estimated for respondents at risk of HSB for primary infertility with coefficients presented as odds ratios. As a reminder, the hazard begins at age 15 for women who are at risk of HSB for primary infertility. Starting at age 22, the effects of maternal age on HSB for women at risk of primary infertility is significant where the rates of HSB for 22-year-old women at risk of primary infertility are 216% greater than women 18-years-old or younger. A few other single-year dummy odds ratios show that 30-year old women have rates of HSB that are 534% greater than 18 year old women, that woman age 35 have rates of HSB that are 1372% greater than women 18-years-old or younger, and that women age 40 have rates of HSB that are 723% greater than women 18-years-old or younger. These rates of HSB are for women at risk of primary infertility.

The overall significant findings of the effects of single-year dummies on the rates of HSB for women at risk of primary infertility, starting at age 22 and in comparison to women 18-years-old or younger, suggest that with each year older, there is an increased risk for HSB for infertility, but that this risk eventually starts to decrease.

In comparison, I present the effects of the single-year dummies on the rates of HSB for women at risk of secondary infertility in Model 2 of Table 6-2. The hazard for women at risk of secondary infertility begins at the age of the first, live birth. Significant effects of the single-year age groups are observed for women age 38 to 45. For example, a woman aged 38 has rates of HSB that are

172% greater than women aged 18-years-old or younger, and women who are 44 to 45 years-old have rates of HSB that are 260% greater than a woman who is age 18 or younger. It is possible that the higher rates of HSB for women at risk of secondary infertility in these older age groups is reflective of the fact that these women have already had one child, presumably at ages younger than 38 and their rates of HSB are observed only after thy have had at least one child, and at later times of the reproductive life cycle. There are however, no significant effects by parity status of the single-year age groups on the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility.

Estimating the single-year age dummies on the rates of HSB is not the most accurate method to testing the effect of maternal age on HSB for primary or secondary infertility. Although these analyses provide a general idea of the effects of maternal age on the rates of HSB, it is subject to error given the relatively low number of HSB cases in each, individual year. Therefore, I estimate the effects of maternal age as 5-year cohorts.

Table 6-3 presents the effects of maternal age as 5-year cohorts on the rates of HSB stratified by parity status. The effects of maternal age are presented for women at risk of primary infertility in Model 1, and the effects of maternal age for women at risk for secondary infertility are presented in Model 2. I test the effects of age as 5-year cohorts because the number of HSB that occurs at each, individual age-year is relatively few, and in some cases may not even exist, therefore using 5-year age cohorts is a more logical approach to estimating the risks for HSB. By looking at age in 5-year cohorts I am also able to consider how demographically dense life events, (i.e. graduating from school, getting a job, getting married) are combined in similar age groups. In Table 6-3, I run two sets of models stratified by infertility status. As with the preceding models, I also run an interactive model to compare the effects of the age cohorts on HSB for primary versus secondary infertile respondents. There are six groups of age-cohorts for women aged 15 to 19, age 20 to 24, age 25 to 29, age 30 to 34, age 35 to 39, and age 40 to 45. The last cohort group includes six years because there were four respondents that were screened for the NSFG survey when they were 44, but they turned 45 by the time they actually participated in the survey. The reference for these analyses is 15 to 19 year age-cohort.

Beginning with the results from Model 1, the lowest rates of HSB are observed for women at risk of primary infertility who are age 20 to 24 and women who are age 40 to 45. This is in comparison to the reference age-cohort, women age 15 to 19. For example, women aged 20 to 24 have HSB rates 177% greater than the reference group, but this is the lowest rates of HSB among all the 5-year age cohorts. The HSB rates for women aged 20 to 24 that are 177% greater makes sense considering that this age demographic is typically just beginning the transition into childbearing and any infertility complications, and subsequent HSB for infertility are just beginning.

For women age 40 to 45 the rates of HSB are 206% greater than women age 15 to 19, which is the second lowest rate of HSB observed among the different age cohorts. One possible explanation for the observed rates of HSB for women in this age cohort is that these women are typically at the end of the reproductive life cycle, they may be less willing to try to get pregnant because of the associated health risks, or they have chosen alternative options of seeking help to achieve a biological pregnancy such as remaining childless or adoption.

The highest rates of HSB among the age cohorts and compared to women age 15 to 19 is observed for women aged 30 to 34, the rates of HSB for these women is 413% greater than women age 15 to 19. The next highest rates of HSB for women at risk of primary infertility is observed among 25 to 29 years whose HSB rates are 398% greater than women age 15 to 19. And finally, women aged 35 to 39 are at risk of HSB for primary infertility at rates that are 388% greater than women age 15 to 19 years old. Overall, the effects of age as five-year cohorts on the rates of HSB for women at risk of primary infertility resembles an upside-down "U" shape where there is an increase in the rates of HSB starting at ages 20 to 25, a peak at the ages of 30 to 24, followed by a decline and lowest rates at age 40 to 45.

In Model 2 in table 6-3 I look at the age cohort effects on the rates HSB for respondents at risk of secondary infertility. In these models the only significant effects of age cohorts on HSB are observed for women aged 35 to 39 and ages 40 to 45. For women aged 35 to 39, the rates of HSB for infertility are 35% greater than women who are age 15 to 19. For women aged 40 to 45, the rates of HSB are 94% greater than women age 15 to 19.

The fully interactive models that compare the effects of maternal age-cohorts on rates of HSB by parity status suggest there are significant differences in HSB for women aged 25 to 29, 30 to 34, and 35 to 39. For example, the rates of HSB for women at risk of primary infertility who are aged 25 to 29 are 398% greater than the reference group, and this is significantly different compared to the rates of HSB for women at risk of secondary infertility who are in the same age cohort. What the findings from the interactive model describe is that the effects of maternal age in the rates of HSB for women at risk of primary infertility compared to woman at risk of secondary infertility are significantly different for women between the ages of 25 to 39. The significant differences by parity status for women between ages 25 to 29 may be explained by the fact that these are the prime reproductive years for most women and any HSB for infertility will likely be observed during this time.

Analytic Procedure for STI Diagnosis

The second biological mechanism I consider in these analyses is any lifetime diagnosis of an STI. I include five common STI's that have been linked to infertility and are available through the NSFG survey design. The five STI are chlamydia, gonorrhea, genital warts, herpes, and syphilis. To test the effects of STI on the odds of HSB for infertility I estimate a logistic regression. I employ a logistic regression for the primary reason that I do not have access to the century-month of diagnosis for the STI as it related to HSB for infertility by parity status. Although this is a limitation of the research, I try to remedy this by running a series of logistic regressions which provide a general idea of the link between STI and HSB for infertility by parity status. In addition, I consider variations in the analyses in an attempt to capture all possible effects of lifetime diagnoses of an STI on the odds of HSB for infertility. In these models, all coefficients are presented as odds ratios and any significant differences by parity status in the interactive models are identified by an 'X'; significant differences would be observed at the .05 level.

In Table 6-4 I present the findings for the logistic regressions predicting the odds of HSB for women a risk of primary or secondary infertility in the presence of any lifetime STI. In Models 1 and 2 I look at the effects of each STI individually. Models 3 and 4 present at the effects of having a diagnosis for any combination of the five STI on the odds of HSB. Beginning with Model 1, the odds of HSB for nulliparous women who have ever been diagnosed with an STI are 77% greater than women who have never been diagnosed with genital warts. Likewise, for parous women at risk of secondary infertility, the odds of HSB in the presence of genital warts are 68% greater than women who have never been diagnosed with warts. However, the difference in the odds of HSB by parity status is not significant. I propose that the significant effect of any lifetime diagnosis of genital warts on the odds of HSB for infertility is not a direct indication of the greater risks for HSB of infertility in the presence of this one, particular STI. However, it is possible that this relationship exists because of the outwardly symptoms of genital warts, compared to the internal symptoms presented in the other STI categories. It is also possible that because genital warts do present external symptoms, there may be earlier screening and diagnosis of this STI that establishes overall patient awareness of the associated risk factors between STI and infertility. Because the effects of one, individual STI do not necessary indicate greater risks of HSB for infertility, I look at a combined effect of having any combination of the five STI diagnosis on the odds of HSB for infertility.

In Models 3 and 4 of Table 6-4 I present the odds of HSB in the presence of having any lifetime STI diagnosis which includes the five individual categories measured in Models 1 and 2. Looking at the combined effects of STI diagnosis on the odds of HSB seems a more appropriate approach in addition to the larger number of observed cases, but also because STI diagnoses for one STI typically increase the risk for an additional STI and the compounding effect of an STI can have long term consequences on infertility. In addition, there is no order to the types of STI an individual can contract, or put anther way, an individual is not infected with one STI first, followed by another and another. An individual can be infected with multiples STI’s in one instance and can also be have repeat infections of the same STI. For these reasons, combining any lifetime STI diagnosis on the odds of HSB is an appropriate analysis.

I hypothesize that any lifetime diagnosis of an STI will increase the odds of HSB for nulliparous women at risk of primary infertility as well as parous women at risk of secondary infertility. However, I expect to find that the effects of lifetime diagnosis of STI will be stronger on the odds of HSB for nulliparous women. This hypothesis is confirmed where the odds of HSB for nulliparous women, who have ever been diagnosed with any STI, are 81% greater than that of women who have never been diagnosed. In comparison, the odds of HSB for parous women at risk of secondary infertility, who have ever been diagnosed with an STI, are 26% greater than women who have never been diagnosed. The difference in the odds of HSB for nulliparous and parous women is significant at the .05 level suggesting that women at risk of primary infertility are significantly more likely to engage in HSB than women at risk of secondary infertility.

Due in part to the limitations of estimating a logistic regression model on the effects of STI diagnosis on the odds of HSB, I test the effects of parity status on the odds of HSB for women who have ever been diagnosed with an STI compared to women who never been diagnosed with an STI. The results from these models are presented in Table 6-5. In Model 1, the odds of HSB for women who are nulliparous, and therefore would be at risk of HSB for primary infertility, who have ever been diagnosed with an STI are 72% greater than women who are parous, or are at risk of secondary infertility. In Model 2, the odds of HSB for women who are nulliparous who have never been diagnosed with an STI are 19% that of parous women who have never been diagnosed with an STI. The differences between these two groups are significant at the .05 level and mirror the logistic regression in Table 6-4. Essentially, both series of models confirm that the effects of any lifetime STI diagnosis increases the odds of HSB for infertility and that the effects are significantly different for parous women versus nulliparous women. However, since I do not have time-ordering of the STI diagnosis, the outcomes are generalizations of the effects of STI on the rates of HSB.

Summary

In this chapter I present two analytical procedures to estimate the effects of maternal age and any lifetime diagnosis of an STI on the rates and odds of HSB for infertility by parity status. The analyses on maternal age are estimated using event-history discrete-time analyses. For maternal age, I hypothesized that the rates of HSB for infertility will resemble an upside 'U' shape such that the HSB rates will increase until the mid-range of the reproductive life cycle, or around age 35, and then there will be a decrease in the rates of HSB. More specifically, I hypothesize that the rates of HSB will be greater for women at risk of primary infertility compared to women at risk of secondary infertility. The findings from the analyses on maternal age confirm this hypotheses with results indicating that the effects of age, between ages 25 to 39, for women at risk of primary infertility are significantly greater than women of these same age groups who are at risk of secondary infertility. It is possible that the predisposing factors associated with increasing maternal age, and that the prime reproductive years are captured in this age range, increase the rates of HSB for women at risk of primary infertility compared to women at risk of secondary infertility.

The second analytical procedure tests my hypothesis that the presence of any lifetime STI diagnosis will increase the odds of HSB for infertility. I propose this relationship because a history of an STI diagnosis is an internal cue that any complications in getting pregnant may be the result of the STI, therefore engaging in HSB for help to get pregnant is necessary. Using a logistic regression to accommodate the lack of time-specific STI diagnoses dates, the odds of any lifetime HSB for infertility are higher for women who have ever been diagnosed with an STI compared to women who have never been diagnosed with an STI. More specifically, the odds of HSB for women who are nulliparous and would be engaging in HSB for primary infertility are significantly higher than the odds of HSB for parous women with any lifetime STI diagnosis that would be engaging in HSB for secondary infertility.

In the next chapter I present the final set of analyses that test is state-level insurance mandates increase the rates of HSB for infertility, but more specifically, if these rates of HSB are significantly different for women at risk of primary infertility compare to secondary infertility.

Table 6-1: Means and Standard Deviations for Age-Related Variables

	Means	Std. Dev.	Minimum	Maximum	N
% with Any lifetime STI Diagnosis	12%	0.32	0	1	11210
% with Specific Type of STI Diagnosis					
Chlamydia	9.7%	0.86	0	1	11210
Gonorrhea	7.4%	0.66	0	1	11210
Genital Warts	4.2%	0.34	0	1	11210
Herpes	4.1%	0.36	0	1	11210
Syphillis	2.22%	0.18	0	1	11210
Age of Respondent	29.6	7.90	15	45	11210
Age of Married Respondent	33.6	6.00	17	45	3924
Age of Cohabiting Respondent	28.4	7.02	16	45	2018
Age of Single Respondent	25.2	7.10	15	45	5268
Age at First Birth	23.2	6.9	15	45	11210
Age at Second Birth	27.6	7.7	17	45	11210
Age at first HSB for Primary Infertility	31.6	7.3	16	45	331
Age at first HSB for Secondary Infertility	34.4	6.4	17	45	909

Source: National Survey of Family Growth, 2006-2010 Continuous Data File

Table 6-2: Effects of Age as Single-Year Dummies on the Risks of Health-Seeking Behaviors for Infertility

Model	1	2
Type of Infertility Risk	Primary	Secondary
Maternal Age[1]		
Age 19	2.41	1.22
Age 20	1.12	1.55
Age 21	2.42	2.01
Age 22	3.16*	2.20
Age 23	2.94*	1.74
Age 24	3.03*	2.30
Age 25	2.83*	1.75
Age 26	4.63*	2.26
Age 27	1.98*	2.46
Age 28	7.89***	3.55
Age 29	7.54***	2.54
Age 30	6.34***	2.51
Age 31	2.31***	2.84
Age 32	11.97***	2.19
Age 33	9.36***	2.30
Age 34	6.22***	2.73
Age 35	14.72***	3.25
Age 36	17.93***	3.31
Age 37	12.14***	3.25
Age 38	17.00***	3.72*
Age 39	4.11**	4.61**
Age 40	8.23***	3.60*
Age 41	15.18***	3.32*
Age 42	9.52***	3.69*
Age 43	15.80***	3.32*
Age 44 to 45	9.03***	3.60*
Person Months	1096316	868176

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is age 18 or younger; [2] Reference group less than a high school degree;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is non-Hispanic white;
[6] Reference group is not married at birth [7] Reference group is less than high school degree;
[8] Reference group is unemployed; [9] Reference group is age 19 or younger

Table 6-2 *(continued)*: Effects of Age as Single-Year Dummies on the Risks of Health-Seeking Behaviors for Infertility

Model	1	2
Type of Infertility Risk	Primary	Secondary
Time-Varying Controls		
Respondents Educational Attainment[2]		
High School Degree (GED Equivalent)	0.91	1.460
Bachelors Degree	0.61	1.613
Graduate Degree (Masters or PhD)	0.78	1.918
Respondents Employment Status		
Working in full or part time employment[3]	0.87	0.910
Cumulative years of full or part time employment		
Respondents Relationship Status[4]		
Married	5.66	1.712
Cohabiting	1.87	1.050
Time-Invariant Controls		
Race/Ethnicity[5]		
Non-Hispanic Black	1.48	0.585
Hispanic	1.12	0.736
Non-Hispanic Other	0.75	0.758
Childhood Sociodemographics		
Biological parents married at birth[6]	0.79	0.896
Mother's Education[7]		
High School/GED	0.82	1.050
Two Years College	0.99	1.078
Bachelor's Degree	0.65	1.275
Mother worked full or part time[8]	0.95	0.877
Mother's age at first baby[9]		
Age 20 to 24	0.70	0.985
Age 25 to 29	0.60	1.080
Age 30 or older	0.58	0.657
Person Months	1096316	868176

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is age 18 or younger; [2] Reference group less than a high school degree;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is non-Hispanic white;
[6] Reference group is not married at birth [7] Reference group is less than high school degree;
[8] Reference group is unemployed; [9] Reference group is age 19 or younger

Table 6-3: Effects of 5-year Age Cohorts on the Risk of Health-Seeking Behaviors for Infertility

Model	1	2	
Type of Infertility Risk	Primary	Secondary	
Maternal Age[1]			
Age 20 to 24	2.77***	1.80	
Age 25 to 29	4.98***	1.95	X
Age 30 to 34	5.13***	1.77	X
Age 35 to 39	4.88***	1.35*	X
Age 40 to 45	3.06**	1.94*	
Time-Varying Controls			
Respondents Educational Attainment[2]			
High School Degree (GED Equivalent)	1.86***	1.27	
Bachelors Degree	3.13***	1.72*	
Graduate Degree (Masters or PhD)	4.06***	1.77	X
Respondents Employment Status			
Working in full or part time employment[3]	2.36***	2.51	X
Cuulative years of full or part time employment	0.88***	1.05*	
Respondents Relationship Status[4]			
Married	4.45***	2.08	X
Cohabiting	1.75	0.78	
Person Months			

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is age 15 to 19; [2] Reference group less than a high school degree;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is non-Hispanic white;
[6] Reference group is not married at birth [7] Reference group is less than high school degree;
[8] Reference group is unemployed; [9] Reference group is age 19 or younger

Table 6-3 *(continued)*: Effects of 5-year Age Cohorts on the Risk of Health-Seeking Behaviors for Infertility

Model	1	2
Type of Infertility Risk	Primary	Secondary
Time-Invariant Controls		
Race/Ethnicity[5]		
Non-Hispanic Black	0.74	0.56**
Hispanic	0.96	0.67**
Non-Hispanic Other	0.76	0.79
Childhood Sociodemographics		
Biological parents married at birth	0.78	1.01
Mother's Education[6]		
High School/GED	1.12	0.82
Two Years College	1.10	0.92
Bachelor's Degree	1.12	1.15
Mother worked full or part time[7]	0.87	1.00
Mother's age at first baby[8]		
Age 20 to 24	0.81	0.89
Age 25 to 29	0.78	0.84
Age 30 or older	0.39	0.62
Person Months	1096316	868176

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is age 15 to 19; [2] Reference group less than a high school degree;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is non-Hispanic white;
[6] Reference group is not married at birth [7] Reference group is less than high school degree;
[8] Reference group is unemployed; [9] Reference group is age 19 or younger

Table 6-4: Effects of any Lifetime Diagnosis of an STI on the odds of Health-Seeking Behavior for Infertility

Model	1	2	3	4	
Type of Infertility Risk	Primary	Secondary	Primary	Secondary	
Individual STI Diagnosis[1]					
Chlamydia	1.64	1.11			
Gonorrhea	1.66	1.40			
Herpes	1.81	1.12			
Genital Warts	1.77**	1.68**			
Syphillis	1.81	1.60			
Any STI Diagnosis			1.81*	1.26*	X
Maternal Age[2]					
Age 20 to 24	1.61	1.78	1.63***	1.78	
Age 25 to 29	3.28***	2.42***	3.35***	2.42***	
Age 30 to 34	4.77***	2.14***	4.94***	2.13***	
Age 35 to 39	5.92***	3.26***	5.19***	3.25***	
Age 40 to 45	4.89***	3.18***	4.10***	3.17***	
Sample Size	4661	6549	4661	6549	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is no STI Diagnosis; [2] Reference group age 15 to 19;
[3] Reference group is less then high school degree; [4] Reference group is unemployed; [5] Reference group is single;
[6] Reference group is non-Hispanic white; [7] Reference group is not married; [8]Reference is unemployed;
[9] Reference group is age 19 or younger

Table 6-4 *(continued):* Effects of any Lifetime Diagnosis of an STI on the odds of Health-Seeking Behavior for Infertility

Model	1	2	3	4
Type of Infertility Risk	Primary	Secondary	Primary	Secondary
Time-Varying Controls				
Respondents Educational Attainment[3]				
High School Degree (GED Equivalent)	0.99	1.43	0.97	1.44
Bachelors Degree	0.69	1.54	0.67	1.56
Graduate Degree (Masters or PhD)	0.92	1.81	0.89	1.83
Respondents Employment Status				
Working in full or part time employment[4]	0.89	0.91	0.89	0.92
Cumulative years of full or part time employment	0.88	0.94	0.87	0.94
Respondents Relationship Status[5]				
Married	4.02***	2.68***	3.93***	1.68
Cohabiting	1.91**	1.04	1.91	1.04
Time-Invariant Controls				
Race/Ethnicity[6]				
Non-Hispanic Black	1.29	0.62	1.34	0.61
Hispanic	1.06	0.73	1.06	0.73
Non-Hispanic Other	0.72	0.76	0.74	0.76
Childhood Sociodemographics				
Biological parents married at birth[7]	0.80	0.89	0.80	0.89
Mother's Education6				
High School/GED	0.80	1.04	0.80	1.04
Two Years College	1.00	1.06	1.00	1.07
Bachelor's Degree	0.69	1.25	0.69	1.26
Mother worked full or part time[8]	0.95	0.88	0.93	0.88
Mother's age at first baby[9]				
Age 20 to 24	0.72	0.97	0.71	0.97
Age 25 to 29	0.61	1.08	0.60	1.08
Age 30 or older	0.59	0.66	0.58	0.66
Sample Size	4661	6549	4661	6549

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type
[1] Reference group is no STI Diagnosis; [2] Reference group age 15 to 19;
[3] Reference group is less then high school degree; [4] Reference group is unemployed; [5] Reference group is single;
[6] Reference group is non-Hispanic white; [7] Reference group is not married; [8]Reference is unemployed;
[9] Reference group is age 19 or younger

Table 6-5: Effects of any Lifetime Diagnosis of an STI on the odds of Health-Seeking Behavior for Infertility

Model	1	2	
Lifetime STI Diagnosis	Any Diagnosis	No Diagnosis	
Parity Status[1]			
Nulliparous (at risk for primary infertility)	1.72**	1.19*	X
Maternal Age[2]			
Age 20 to 24	1.87	2.01	
Age 25 to 29	2.33*	3.15***	
Age 30 to 34	3.03*	4.38***	
Age 35 to 39	3.94*	5.68***	
Age 40 to 45	2.43*	5.39***	
Time-Varying Controls			
Respondents Educational Attainment[3]			
High School Degree (GED Equivalent)	1.09*	1.28*	
Bachelors Degree	2.25**	1.56**	
Graduate Degree (Masters or PhD)	2.60**	1.88**	
Respondents Employment Status			
Working in full or part time employment[4]	0.99	0.90	
Cumulative years of full or part time employment			
Respondents Relationship Status[5]			
Married	2.00***	2.77***	
Cohabiting	1.27***	1.39**	
Sample Size	2876	8334	

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is parous (secondary infertility risk); [2] Reference group age 15 to 19;
[3] Reference group is less then high school degree; [4] Reference group is unemployed; [5] Reference group is single;
[6] Reference group is non-Hispanic white; [7] Reference group is not married; [8]Reference is unemployed;
[9] Reference group is age 19 or younger

Chapter 7

CONTEXTUAL EFFECTS AND HEALTH-SEEKING BEHAVIORS

Chapter Seven presents the outcomes and results from the analyses testing the contextual effect of state-level insurance mandates that infertility testing, treatment and services be included in health-insurance programs, or the states offer the option to purchase coverage for infertility-related medical needs. Previous studies have demonstrated that neighborhood contexts like racial/ethnicity diversity, socioeconomic status, and educational and professional employment opportunities influence resident behaviors - including their health behaviors (Diez-Roux, 2003; Lochner, Kawachi, Brennen, & Buka, 2003; Macintyre & Ellaway, 2003). This occurs though multiple pathways such as family, peer and social relationships within the community that promote or discourage health behaviors. These individual level relationships influence the social norms and expectations of desirable health behaviors. But more importantly for this study, is the influence that community context has on the availability and access to institutional resources that enhance opportunities to engage in desirable health behaviors. For the purpose of this dissertation this means residing in a state that has state-level insurance mandates for infertility treatments.

In the sections that follow, I present the findings from a series of models that test the effects of state-level insurance mandates on the rates of HSB. I begin by describing the descriptive statistics for these analyses.

Descriptive Statistics

There are fifteen states with insurance mandates that insurance programs either cover, or offer-to-cover infertility services. These states, listed alphabetically, include Arkansas, California, Connecticut, Hawaii, Illinois, Louisiana, Maryland, Massachusetts, Montana, New Jersey, New York, Ohio, Rhode Island, Texas, and West Virginia. Approximately 37% of the women in this research sample lives in one of these states. 74% of the sample has lived in the same state since 2000. As a reminder, in one set of analyses I make the assumption that if someone has lived in the same state since 2000, they have also lived in the same state since birth, or, at the very minimum they have lived in states that have similar political, economic, or social policy environments that would subsequently impact information, resources, and access to reproductive health services. Of the sample that has ever experienced HSB for infertility, 54% of those HSB events occurred prior to and including 1999. The remaining 46% of the sample that have experienced an HSB had this event occur after and including 2000. Therefore, when I test the analyses with the assumption that people have lived in the same state since 2000, or when I only look at HSB after 2000, I am observing approximately half of the HSB events in this sample, which considering the limitations of the data, is an adequate analytical approach.

Analytic Procedures

In the first set of analyses I hypothesize that respondents who have lived in the same state since 2000 will have also lived in the same state since birth, or, if they have not lived in the same state, that any state they have lived in will have similar state-level effects as the state they live in 2000. In Table 7-2, Model 1 I look at the individual state-level effects on the rates of HSB for women at risk of primary infertility. In Model 2 I look at these same individual state-level effects for women at risk of secondary infertility. In both set of analyses there are no significant individual state-level effects on the rates of HSB for either type of infertility risk, but more importantly for the purpose of this dissertation, there are no significant effects between women at risk of primary infertility compared to women at risk of secondary infertility. It is possible that the lack of significance in predicting the rates of HSB are the result of the relatively low number of HSB events in any one particular state, and that a better approach would be to look at the effect of state-level insurance mandates for all 15 states combined.

In Table 7-3, Model 1 I look at the combined effect of residing in a state with state-level mandates for women at risk of primary infertility who have lived in the same state since 2000, and whom I assume have lived in the same state since birth. In Model 1 the results indicate that for women at risk of primary infertility, who have lived in the same state since 2000, and have lived in a state that mandates insurance coverage or offer-to-cover infertility services, the rates of HSB are 76% greater than women who do not live in states with state-level insurance mandates. Based on the Health Belief Model, residing in states with state-level insurance mandates is an enabling resources that not only provides access and availability to insurance that covers infertility, but these states may have additional state-level effects that positively influence HSB for infertility. For example, more prominent public health programs geared at educating the public about infertility complications. Likewise, residing in states with state-level insurance mandates is an external cue that can promote public knowledge and awareness that insurance programs are available to women who are interested and in need of infertility assistance. Therefore, the higher rates of HSB for women at risk of primary infertility, residing in states with mandates, may be explained by these enabling resources and external cues. In Model 2 of Table 7-3 I present the results for women at risk of secondary infertility, but, the effects of state mandates on the rates of HSB for these women are not significant. Likewise, there are no significant differences in the rates of HSB by parity status.

In Table 7-4, I remove any assumptions about place of residence since birth, and only consider the effects of state residence from the year 2000 onward. I select this particular year because I have information about where a respondent has lived since 2000 until the end of the NSFG survey period. In comparison, the previous models control for where the respondent lived in 2000, but make the assumption that living in the same state since 2000 can also be applied to living in the same state since birth. Model 1 of Table 7-4 presents the rates of HSB for women at risk of primary infertility occurring any time after the year 2000, based on the individuals state-level effects. In Model 2 I consider the same analyses but focus on women who are at risk of secondary infertility. In both Model 1 and Model 2 there are no significant effects of the individual state-level mandates on the rates of HSB for either type of infertility risk. This lack of significance in the rates of HSB during the risk period from 2000 onward mirrors the lack of significance for rates of HSB when I assume state-of-residence has remained the same. Similar to the reasoning for the models in Table 7-2, the low numbers of HSB observed at each individual state level, or the low number of HSB events observed from 2000 onward may contribute to the lack of significance among and between women at risk of primary versus secondary infertility.

The final set of analyses I consider looks at the combined effect of residing in a state with state-level insurance mandates for infertility services. In this series of models, I control for where someone lived since 2000 and only look at century months of risk for HSB from 2000 onward. In Model 1 of Table 7-5, the rates of HSB for women at risk of primary infertility who live in states with state-level insurance mandates are 65% greater than the rates of women who reside in states without any insurance mandates. The rates however for women at risk of secondary infertility residing in states with mandates are not significantly different than women at risk of secondary infertility residing in states without mandates. More importantly, there are no significant differences in the rates of HSB by parity status if the women live in states with mandates.

Summary

My overall hypothesis regarding the rates of HSB for infertility based on residing in states with state-level insurance mandates for infertility services was that the rates of HSB would be higher for women in these states, compared to women residing in states without mandates, but more importantly, that the rates of HSB would be higher for women at risk of primary infertility residing in states with insurance mandates compared to women at risk of secondary infertility residing in states with mandates. In general, my hypotheses were not confirmed. The only exception was the case of women at risk of primary infertility, who reside in any state with insurance mandates, have higher rates of HSB than women at risk of primary infertility who reside in states without mandates. For the purpose of this dissertation, the hypothesis regarding differences in the rates of HSB by parity status was not observed. In the next chapter I provide further detail and explanation regarding the overall findings of all the substantive chapters, implications of this research, and future research plans.

Table 7-1: Means and Standard Deviations for Contextual Effects

	Means	Std. Dev.	Minimum	Maximum	N
Reside in state mandating insurance coverage	0.25	0.43	0	1	11210
Reside in state mandating coverage be offered	0.20	0.39	0	1	11210
Lived in Same State since 2000	0.74	0.43	0	1	11210
Year of HSB (if HSB occurred)					
% Before and including 1999	0.54	0.49	0	1	1243
% On and after 2000	0.46	0.35	0	1	1243

Source: National Survey of Family Growth, 2006-2010 Continuous Data File

Table 7-2: State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services for Respondents Assumed to be Living in Same State since Birth

Model	1	2
Type of Infertility Risk	Primary	Secondary
State-Level Mandates for Insurance Coverage[1]		
Arkansas	1.64	1.58
California	1.86	1.20
Connecticut	1.13	1.61
Hawaii	1.19	1.84
Illinois	1.19	1.99
Louisiana	1.35	1.97
Maryland	1.24	1.69
Massachusetts	1.91	1.99
Montana	1.96	1.98
New Jersey	1.99	1.92
New York	1.25	1.93
Ohio	1.94	1.31
Rhode Island	1.93	1.60
Texas	1.08	1.77
West Virginia	1.92	1.14
Time-Varying Control Measures		
Educational Attainment[2]		
High School Degree (GED Equivalent)	1.81**	1.35
Bachelors Degree	2.41**	1.84
Graduate Degree (Masters or PhD)	3.81**	1.86
Employment Status		
Working in full or part time employment[3]	1.45***	1.67*
Cumulative years of employment	1.27***	1.16
Relationship Type[4]		
Married	3.57***	2.17*
Cohabiting	1.84	0.89
Person Months	822597	654994

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference is unemployed; [4] Reference is single;
[5] Reference group is age 15 to 19; [6] Reference group is non-Hispanic white;
[7] Reference group is not married; [8] Reference group less than high school;
[9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-2 *(continued)*: State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services for Respondents Assumed to be Living in Same State since Birth

Model	1	2
Type of Infertility Risk	Primary	Secondary
Time-Invariant Controls		
Age Cohorts[5]		
20-24	2.80	1.92
25-29	5.06	1.97
30-34	7.31	1.87
35-39	5.11	1.44
40-45	3.21	1.98
Race/Ethnicity[6]		
Non-Hispanic Black	0.65	0.47
Hispanic	0.95	0.76
Non-Hispanic Other	0.67	0.84
Childhood Sociodemographics		
Biological parents married at birth[7]	1.87	1.01
Mother's Education & Employment Status[8]		
High School/GED	1.08	1.24
Two Years College	1.21	1.92
Bachelor's Degree	1.19	1.84
Mother worked full or part time[9]	0.88	0.99
Mother's Age at First Baby[10]		
Age 20 to 24	1.92	1.89
Age 25 to 29	1.87	1.86
Age 30 or older	1.52	1.72
Person Months	822597	654994

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference is unemployed; [4] Reference is single;
[5] Reference group is age 15 to 19; [6] Reference group is non-Hispanic white;
[7] Reference group is not married; [8] Reference group less than high school;
[9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-3: Combined Effects of State Mandates to Cover/Offer-to-Cover Infertility Services for Respondents Assumed to be Living in Same State since Birth

Model	1	2
Type of Infertility Risk	Primary	Secondary
State-Level Mandates for Insurance Coverage[1]	1.76*	1.19
Time-Varying Control Measures		
Educational Attainment[2]		
High School Degree (GED Equivalent)	1.71**	1.15
Bachelors Degree	3.08**	1.58
Graduate Degree (Masters or PhD)	6.10**	1.84
Employment Status		
Working in full or part time employment[3]	2.46**	2.61***
Cumulative years of employment	0.91	1.07
Relationship Type[4]		
Married	3.41***	2.16***
Cohabiting	1.94	0.87
Person Months	822597	654994

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is age 15 to 19;
[6] Reference group is non-Hispanic white; [7] Reference group is not married;
[8] Reference is less than high school; [9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-3 *(continued)*: Combined Effects of State Mandates to Cover/Offer-to-Cover Infertility Services for Respondents Assumed to be Living in Same State since Birth

Model	1	2
Type of Infertility Risk	Primary	Secondary
Age Cohorts[5]		
20-24	2.87	1.91
25-29	5.01	1.86
30-34	7.26	1.88
35-39	4.75	1.26
40-45	3.07	1.94
Race/Ethnicity[6]		
Non-Hispanic Black	0.81	0.47
Hispanic	0.96	0.72
Non-Hispanic Other	0.84	0.68
Childhood Sociodemographics		
Biological parents married at birth[7]	0.87	1.01
Mother's Education & Employment Status[8]		
High School/GED	1.24	1.94
Two Years College	1.21	1.98
Bachelor's Degree	1.24	1.26
Mother worked full or part time[9]	0.99	1.00
Mother's Age at First Baby[10]		
Age 20 to 24	0.92	0.89
Age 25 to 29	0.83	0.83
Age 30 or older	0.45	0.72
Person Months	822597	654994

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is age 15 to 19;
[6] Reference group is non-Hispanic white; [7] Reference group is not married;
[8] Reference is less than high school; [9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-4: Effects of State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services on HSB for Infertility from 2000-2010

Model	1	2
Type of Infertility Risk	Primary	Secondary
State-Level Mandates for Insurance Coverage[1]		
Arkansas	1.32	1.65
California	1.73	1.45
Connecticut	1.86	1.46
Hawaii	1.36	1.65
Illinois	1.91	1.95
Louisiana	1.08	1.61
Maryland	1.24	1.06
Massachusetts	1.74	1.97
Montana	1.76	1.84
New Jersey	1.91	1.93
New York	1.91	1.98
Ohio	1.72	1.82
Rhode Island	1.69	1.21
Texas	1.66	1.92
West Virginia	1.74	1.96
Time-Varying Control Measures		
Educational Attainment[2]		
High School Degree (GED Equivalent)	1.73**	1.78
Bachelors Degree	3.34**	2.67***
Graduate Degree (Masters or PhD)	3.41**	1.88
Employment Status		
Working in full or part time employment[3]	1.97**	2.11***
Cumulative years of employment	0.92	0.93
Relationship Type[4]		
Married	3.06***	1.65***
Cohabiting	1.89	0.91
Person Months	438718	244531

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference is unemployed; [4] Reference is single;
[5] Reference group is age 15 to 19; [6] Reference group is non-Hispanic white;
[7] Reference group is not married; [8] Reference group less than high school;
[9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-4 (continued): Effects of State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services on HSB for Infertility from 2000-2010

Model	1	2
Type of Infertility Risk	Primary	Secondary
Time-Invariant Controls		
Age Cohorts[5]		
20-24	2.62	1.10
25-29	4.45	1.66
30-34	7.36	2.13
35-39	4.56	1.78
40-45	2.41	2.73
Race/Ethnicity[6]		
Non-Hispanic Black	0.82	0.62
Hispanic	0.92	0.86
Non-Hispanic Other	0.52	0.92
Childhood Sociodemographics		
Biological parents married at birth[7]	0.92	0.95
Mother's Education & Employment Status[8]		
High School/GED	1.45	1.64
Two Years College	1.23	1.88
Bachelor's Degree	1.38	1.84
Mother worked full or part time[9]	0.95	0.98
Mother's Age at First Baby[10]		
Age 20 to 24	1.95	1.95
Age 25 to 29	1.91	1.36
Age 30 or older	1.68	1.82
Person Months	438718	244531

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference is unemployed; [4] Reference is single;
[5] Reference group is age 15 to 19; [6] Reference group is non-Hispanic white;
[7] Reference group is not married; [8] Reference group less than high school;
[9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-5: Effects of State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services on HSB for Infertility from 2000-2010

Model	1	2
Type of Infertility Risk	Primary	Secondary
State-Level Mandates for Insurance Coverage[1]	1.65*	1.14
Time-Varying Control Measures		
Educational Attainment[2]		
High School Degree (GED Equivalent)	1.54***	1.52
Bachelors Degree	3.01***	2.64***
Graduate Degree (Masters or PhD)	4.58***	1.07
Employment Status		
Working in full or part time employment[3]	2.84***	2.18***
Cumulative years of employment	0.92	0.95
Relationship Type[4]		
Married	3.25***	1.84***
Cohabiting	1.61	0.67
Person Months	438718	244531

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is age 15 to 19;
[6] Reference group is non-Hispanic white; [7] Reference group is not married;
[8]Reference is less than high school; [9] Reference is unemployed; [10] Reference is age 19 or younger

Table 7-5 ***(continued):*** **Effects of State-Level Insurance Mandates to Cover/Offer-to-Cover Infertility Services on HSB for Infertility from 2000-2010**

Model	1	2
Type of Infertility Risk	Primary	Secondary
Time-Invariant Controls		
Age Cohorts[5]		
20-24	2.68	1.01
25-29	4.18	1.41
30-34	6.86	1.81
35-39	7.56	1.72
40-45	9.86	2.43
Race/Ethnicity[6]		
Non-Hispanic Black	1.15	0.74
Hispanic	1.28	0.74
Non-Hispanic Other	1.04	0.76
Childhood Sociodemographics	0.82	0.83
Biological parents married at birth[7]		
Mother's Education & Employment Status[8]		
High School/GED	1.42	0.85
Two Years College	1.17	1.04
Bachelor's Degree	1.32	0.95
Mother worked full or part time[9]	0.99	0.97
Mother's Age at First Baby[10]		
Age 20 to 24	0.95	0.92
Age 25 to 29	0.91	0.88
Age 30 or older	0.85	0.79
Person Months	438718	244531

Coefficients are odds ratios
*p<.05, **p<.01, ***p<.001
'X' indicates significant (p<.05) difference by infertility risk type

[1] Reference group is living in state without mandates; [2] Reference group is less than high school;
[3] Reference group is unemployed; [4] Reference group is single; [5] Reference group is age 15 to 19;
[6] Reference group is non-Hispanic white; [7] Reference group is not married;
[8]Reference is less than high school; [9] Reference is unemployed; [10] Reference is age 19 or younger

Chapter 8

CONCLUSION

The purpose of this dissertation was to compare the health-seeking behaviors of women who are at risk of primary infertility to the health-seeking behaviors for women who are at risk of secondary infertility. I developed a broad, theoretical framework that considered two models of HSB. The first was the Behavioral Model of Health Services Utilization, that links the presence of predisposing factors like age, education, and employment, with the presence of enabling resources like relationship status, to engaging in health-seeking behaviors (Anderson 1995; Anderson 1968) The second model was the Health Belief Model that states internal cues like a lifetime diagnosis of an STI, residing in states with state-level insurance mandates, influence the likelihood of health-seeking behaviors (Stretcher and Rosenstock, 1997; Janz and Becker, 1984; Becker, 1974). I expanded on these HSB models and proposed that in the presence of select social factors, biological mechanisms, and contextual effects, the rates of HSB for women at risk of primary infertility would be significantly different compared to women at risk of secondary infertility. In Chapter Five, I tested the effects of having more education, being employed, the cumulative number of years of employment, and relationship type and relationship duration on the rates of HSB for infertility and hypothesized that in the presence of these social factors, the rates of HSB for infertility would be higher for women at risk of primary infertility compared to women at risk of secondary infertility. In

Chapter Six, I tested the effects of maternal age and any lifetime diagnosis of an STI and hypothesized that women at risk of primary infertility would have higher rates of HSB compared to women at risk of secondary infertility. In Chapter Seven, I proposed that residing in states with state-level insurance mandates requiring infertility services be covered by health insurance programs, or at the minimum, that health insurance programs offer to include infertility services would increase the rates of HSB for infertility. More specifically, that the rates of HSB would be higher among women living in states with insurance mandates who are at risk of primary infertility compared to women in these same states who are at risk of secondary infertility, My overarching hypothesis for this dissertation was that in the presence of select social factors, biological mechanisms, and contextual effects, the rates of HSB for infertility would be higher for women at risk of primary infertility, compared to women at risk for secondary infertility. In this final chapter I briefly summarize the findings from each of the three substantive chapters and link the implications of these findings to a greater, public and reproductive health outcome. In addition, I conclude the discussions on each of the substantive chapters by discussing plans for future research. I begin by reviewing the effects of social factors on the rates of HSB for infertility. This is followed by a review of the biological mechanisms, and finally, the contextual effects.

Social Factors and Health-Seeking Behaviors for Infertility

Findings

My overarching hypothesis regarding the effects of social factors on HSB for infertility was that in the presence of select social factors, the rates of HSB for infertility would be stronger for women who were at risk of primary infertility, compared to the rates of HSB for women who were at risk of secondary infertility. The selected social factors I included were educational attainment, employment status, and relationship status. I included these specific social factors in part because the they had been identified as predisposing factors and enabling resources through the Behavioral Model of Health Services Utilization in predicting HSB, in part because they had previously been linked to influencing fertility and infertility outcome, and because they were time-varying measures that could change as the hazard progressed.

Educational attainment was measured as the highest degree completed in the month prior to the risk of HSB. My hypotheses specific to education were that the rates of HSB for infertility would increase the more education a woman had, and that there would be significantly higher rates of HSB for women at risk of primary infertility compared to the rates of HSB for women at risk of secondary infertility. I anticipated this outcome because education is a predisposing factor that increases the availability of financial, social, or emotional resources that would influence HSB for infertility. In addition, with more education, the greater ease a woman would have in maneuvering the infertility testing and treatment process, which also increases the likelihood of engaging in HSB. The results indicated that among women at risk of primary infertility the rates of HSB did increase with more education. For example, compared to women with less than a high school degree, the rates of HSB were higher for women with a high school degree, were even higher among women with a bachelor's degree, and the highest rates of HSB were observed among women at risk of primary infertility who have a graduate degree. Similar trends were observed among women at risk of HSB for secondary infertility. With each higher degree completed, and compared to women with less than a high school diploma, the rates of HSB for women at risk of secondary infertility significantly increased. The findings from these analyses supported my overarching hypothesis that with more education the rates of HSB for infertility increased. However, my specific hypothesis in regards to the differences in rates of HSB based on parity status was not confirmed. Even though educational attainment was a predisposing factor that significantly increased the rates of HSB among women at risk of primary or secondary infertility, the difference by parity status was not significant. Therefore, having more education and having increased access to the information, financial, or social resources that were affiliated with educational attainment were not significant in predicting differences in HSB for women at risk of primary versus secondary infertility.

The next logical step after testing the effects of education on HSB for infertility was testing employment status on HSB which was based in part on the traditional demographic transitions present in the U.S. that employment typically follows the completion of educational attainment, and because employment is also predisposing factor that increases exposure and access to resources that can increase the likelihood of HSB. Employment status was measured as being employed in either full- or part-time, paid employment in the month prior to the risk of HSB. I hypothesized that being employed would increase the rates of HSB and that this would be stronger for women who were at risk of primary infertility compared to women at risk of secondary infertility. Being employed did indeed increase the rates of HSB for both types of infertility risks; however, my hypothesis that there would be a significant difference in HSB by parity status was not confirmed.

An interesting finding from the analyses of employment was the effect of cumulative years of employment on the rates of HSB by parity status. I hypothesized that with more cumulative years of employment, the rates of HSB for women at risk of primary infertility would be higher than the rates for women at risk of secondary infertility. My hypothesis was not confirmed, and in fact, the significant difference observed by parity status suggests that women at risk of secondary infertility have higher rates of HSB compared to women at risk of primary infertility. This unexpected outcome may be explained by the fact that the resources available through cumulative years of employment, that I hypothesized would increase the HSB for nulliparous women because they did not have to commit any of the resources to their existing children, actually restricts nulliparous women from engaging in HSB. For example, a nulliparous women who has access to resources (i.e. financial or social) may be committing those resources towards other, non-fertility related responsibilities. In comparison, the parous woman who has already begun committing some of the resources towards her existing children is prepared and willing to continue doing so, including engaging in HSB when infertility arises. Although I did not include the motherhood-wage penalty in my theoretical reasoning of this dissertation, it is worth noting that in light of cumulative years of employment, parous women may have already exited, and re-entered the workforce when they had their first child, and doing so again for any subsequent children would not be considered as big of a professional-risk. In comparison, the nulliparous woman may have not left the workforce yet and doing so to engage in HSB for infertility may not be desirable.

The final measure I considered is relationship status which included an examination of relationship type and relationship duration. I hypothesized that women at risk of primary infertility who were married or cohabiting would have higher rates of HSB than single women. The results supported this finding, and actually, women who were married had higher rates of HSB than women who were cohabiting. However, the only significantly different outcomes by relationship type were observed among women who were at risk of primary infertility, who had been in a relationship for 3 to 5 years. Under this circumstance, the rates of HSB were significantly higher for married women compared to cohabiting women. Per my proposed models of HSB, these results were observed because of the enabling resources that are more abundant within marriage versus a cohabiting union. For example, perceptions of a long-term, stable commitment within marriage that would be able to support, both financially and emotionally, the process of engaging in HSB for infertility.

In addition, I hypothesized that the longer a couple was together, the higher their rates of HSB. For women at risk of primary infertility, the effects of relationship duration did increase the rates of HSB, for married and cohabiting women (compared to single women) but when I specifically tested for the effects of duration, the only significant outcomes were observed among women who had been married for less than 1 year to those married for 1 to 3 years, and, among women who had been married for 1 to 3 years compared to those married for 3 to 5 years. The significantly higher rates of HSB as the time of being married increase in duration may be explained by the fact that marriage is an enabling resource, that over time increases the quantity and availability of resources such as financial stability, perceptions of long term relationship stability, or even emotional support that would promote engaging in HSB for infertility. It is also possible that prior to getting married, couples have already spent a considerable amount of time together, either exclusively dating or even cohabiting, and the transition to childbearing, and subsequently seeking help to get pregnant if infertility complications arise, is more likely within marriage than a cohabiting union.

The effects of relationship duration on the rates of HSB for women at risk of secondary infertility were only significant among married women and only significantly different for women married for 1 to 3 years to those married 3 to 5 years. It is possible that the findings from the relationship duration analyses stems from unobserved effects of being in a relationship, specifically, shared fertility preferences which can influence both fertility intentions and HSB for infertility. However, this research did not test for fertility intentions, and I acknowledge that any unobserved effects of fertility preferences within a relationship are a limitation to fully understanding the effect of relationship duration on rates of HSB for infertility.

Implications

The results from these analyses have two implications for the existing research on fertility and health-seeking behaviors. The first is the identification of social factors that influence HSB within groups of women at risk of primary infertility and women at risk of secondary infertility. The second is a comparison of the rates of HSB by these two types of infertility risk. Beginning with educational attainment, the lack of significant findings between groups of women at risk of primary infertility compared to women at risk of secondary infertility is not indicative that education is not an important factor in predicting HSB. As the results indicate, among women at risk of primary infertility, more education increased the rates of HSB, and similarly, among women at risk of secondary infertility, education increased the rates of HSB. One possible explanation why there is a lack of significance in the rates of HSB between women at risk of primary versus secondary infertility is that traditional educational attainment occurs at younger, or earlier years of the reproductive life cycle for women (Davis, Hall, & Kaufmann, 2007; Martin, 2000). For example, the traditional age for a high school graduate is 18 years old, and for a graduate with a bachelor's degree is 23 years old (U.S National Center for Education Statistics, retrieved May 2012). These ages represent the beginning of the reproductive life cycle for women and, taking into consideration that HSB for infertility typically occur after 2 to 3 years of infertility, any difference in HSB by parity status would not be expected at the beginning of the reproductive life cycle. Therefore, any differences in HSB by parity status, in the presence of educational attainment, are also less likely to be observed.

To explain the findings from the cumulative years of employment on the rates of HSB for infertility I draw upon the concept of the motherhood-wage-penalty that suggests during the prime childbearing years, women with children suffer from lower wages, fewer professional advancement opportunities, and job instability (Anderson, Binder, & Krause, 2002; Budig & England, 2001). Combined with the theory that the benefits and resources available to employed women acts as predisposing factors, increasing the likelihood of engaging in HSB, the concept of the motherhood-wage-penalty can explain why, with more cumulative years of employment, women at risk of secondary infertility have significantly higher rates of HSB compared to women at risk of primary infertility. I proposed that women at risk of secondary infertility, otherwise identified as parous women, would have already experienced an exit and re-entry into the workforce that occurred during the birth of their first child. According to the mother-hood-wage penalty, this exit and re-entry into the workforce would have impacted a woman’s professional trajectory. In light of this penalty, a woman at risk of secondary infertility would be more likely to engage in HSB for infertility because she has already experienced the wage-penalty. In addition, the effect of the wage-penalty combined with the effect of the predisposing factors of cumulative years of employment, are possible reasons why parous women, at risk of secondary infertility, had significantly higher rates of HSB compared to nulliparous women at risk of primary infertility.

As predicted, the rates of HSB for married or cohabiting women at risk of primary infertility or secondary infertility were significantly higher than the rates of HSB for single women. Being in a relationship, compared to being single, provides access to enabling resources such as emotional support, pooled financial resources, social support, and perceptions of long-term relationship stability or commitment, which is linked to increasing the likelihood of engaging in HSB for infertility. The findings regarding relationship type are important contributions to the existing literature on infertility and HSB, as well useful tools for public and medical health professionals working with patients seeking infertility assistance. The main contribution is a better understanding regarding the health behaviors of parous women even in the presence of enabling resources from being in a relationship. For parous women experiencing secondary infertility, the enabling resources that come from being in a relationship are assumed to be partially committed towards parenting and childrearing. For this reason, the ability and opportunity to engage in HSB for infertility may be less available when compared to a nulliparous woman. However, and without testing or controlling for fertility intentions, the results from these analyses indicate that even though parous women have lower rates of HSB compared to nulliparous women, the parous woman at risk of infertility is still more likely to engage in HSB than the single woman.

Future Research

In light of the fact that the selected social factors had the expected outcomes on the rates of HSB among women at risk of primary infertility and among women at risk of secondary infertility, the next step would be to look at couple-level effects and total parity-number effects on the rates of HSB for infertility. An analysis at the couple-level would provide further insight into how the predisposing factors and enabling resources that present themselves within educational attainment, employment status, and relationship status influence rates of HSB at the individual level as well as at the couple level. For example, if, within a couple, one partner has a higher level of education, or has more cumulative years of employment this assumingly would provide benefits for both partners in the relationship, ultimately impacting the rates of HSB. In addition, by comparing individual-level effects to couple-level effects on HSB can provide further insight into how gender differences persist among infertility-related health-behaviors. This suggests an additional research potential in looking at the rates of HSB by gender, regardless of couple status. To conduct a couple-level effect analyses I would need to consider a different data source however because the NSFG does not proved couple-level information regarding infertility behaviors.

Earlier in the dissertation I address the fact that I do not test specifically for total parity number among parous women. I do not consider total parity for this dissertation as the focus is on establishing differences by parity status, but future research could examine if the social factor effects persist for women at risk of secondary infertility in the presence of 1, 2, 3 or more children. This is a worthwhile examination because it provides even more detailed understanding of the factors that influence HSB for women at risk of secondary infertility.

Biological Mechanisms and Health-Seeking Behaviors for Infertility Findings

I begin discussing the findings from the event-history analyses testing the effects of maternal age on the HSB for infertility followed by the findings of the logistic regression testing the effects of lifetime diagnosis of an STI on the odds of HSB. I hypothesized that the effects of maternal age would resemble an upside 'U' on the rates of HSB. Therefore, I expected to find that the rates of HSB would increase and then eventually decrease with age. I expected to find significant effects of maternal age on the rates of HSB because maternal age, or more specifically advancing maternal age, is a predisposing factor for increased risks of infertility complications. For this reason, I hypothesized that advancing maternal age would also increase the risks for HSB for infertility. In the first series of analyses on maternal age I looked at age as single-year dummies and I observed significant results on the rates of HSB among women at risk of primary infertility, and among women at risk of secondary infertility. However, there were no significant differences in the rates of HSB by parity status.

The next set of analyses tested the effects of age as a series of 5-year cohorts, using women age 15 to 19 as the reference group and including women who are age 45 in the last cohort. I hypothesized that the older age cohorts would have higher rates of HSB and that women at risk of primary infertility, among these older cohorts, would have higher rates compared to women at risk of secondary infertility. The results from these analyses supported my hypothesis and presented an interesting finding in regards to just how much higher the rates of HSB are for women at risk of primary infertility compared to women at risk of secondary infertility. For example, women ages 25 to 29 who were at risk of primary infertility had rates of HSB 398% greater than the reference group, whereas the rates of women at risk of secondary infertility were only 95% greater than the reference group. Another example of this extreme range of rates by age-cohort was women who were ages 30 to 34. For women in this age cohort who were at risk of primary infertility, their rates of HSB were 413% greater than the reference group, whereas the rates of HSB for women at risk of secondary infertility was only 77% greater than the reference group.

The first explanation for the significant differences in the effects of age on the rates of HSB by parity status is that age is predisposing factor both for risks of infertility, and as the results indicate here, risks for HSB. This is significant for both types of infertility risk. However, the significantly stronger relationship between maternal age and rates of HSB women at risk of primary infertility can be explained by the parity status. It is possible that unobserved effects of age, such as decreased fecundity, contributed to higher rates of HSB among older age cohorts. It is a limitation of this research to not directly test or control for the unobserved effect of decreased fecundity when examining the effect of maternal age, but it is possible with future research designs to include a measure of fecundity with age as predictors for current, as opposed to retrospective, rates of HSB for infertility.

When I tested the effects of any lifetime STI diagnosis on the odds of HSB I estimated a logistic regression because I did not have the time-specific dates when a woman was diagnosed with an STI, in relation to the risk of HSB. However, given that the number one cause of preventable infertility in the U.S. are sexually transmitted infections, combined with the higher prevalence rates of STI among young women, estimating a logistic regression analyses provided useful information in regards to the links between STI and HSB for infertility.

With the exception of any lifetime diagnosis of genital warts, the findings from the analyses testing the effects of one specific STI diagnosis on the odds of HSB were not significant. The lone significance of genital warts on the odds of

HSB for women at risk of primary or secondary infertility may be explained in part because of the outwardly, symptoms of genital warts. For example, self-diagnosis of genital warts may be more likely because, unlike the other STI in these analyses, there are external rather than internal symptoms. However, the significant effects of genital warts are likely explained by the number of respondents who have ever had a diagnosis for genital warts. In addition, there is no time-ordering in the types of STI infection, such that an individual will be infected with one type of STI, followed by the next, and so on. Put another way, a respondent is at risk of being infected with any of the selected STI at any time, and in any order. For these reasons, I looked at any lifetime diagnosis of any STI on the odds of HSB for infertility. The findings from these analyses suggest that in the presence of any diagnosis of an STI over the lifetime, the odds of HSB for nulliparous women were significantly different than the odds of HSB for parous women.

Because the findings from the analyses testing the effects of lifetime diagnosis of an STI were a logistic regression, and there is no time-ordering of diagnosis of an STI prior to the risk of HSB for infertility, these findings must be interpreted with caution. The utility of these findings indicated higher odds of HSB for women ever diagnosed with an STI, and suggested significant differences by parity status. If I consider that any lifetime diagnosis of an STI is an internal cue that prompts women experiencing any infertility complications, then the slightly lower odds of HSB observed among parous women may be explained by the fact that a previous pregnancy, and the prenatal care associated with that pregnancy, would have diagnosed, and treated any STI prior to the attempt to get pregnant again. However, the limitation of not having date-specific STI diagnoses relative to HSB dates restricted any further interpretation of these results. An additional limitation is the unobserved mechanisms in which the internal cues of a prior STI operate in predicting HSB for infertility, however, in light of these limitations, the findings from these analyses provide useful information in regards to the relationship between any lifetime diagnosis of an STI and future HSB for infertility.

Implications

In consideration of the existing literature that linked maternal age and sexual health histories to risks of infertility, the main contribution of this research was the comparative analysis of HSB for women at risk of primary infertility compared to women at risk of secondary infertility. In regards to maternal age, the significant differences in the rates of HSB by parity type is important for studying fertility trends in population studies, for medical health professionals working with women experiencing infertility, and for public health campaigns geared at educating the public about health fertility behaviors. For example, as changing social trends influence the age when women have their first birth, so too will changes be observed at the age when women engage in HSB for infertility. Put another way, the increasing or older ages when a woman transitions into childbearing will also be observed in the increasing or older ages when a woman engages in HSB for infertility. Given that the success of infertility treatments is also sensitive to the age of the woman, waiting to engage in HSB until the woman is at an advanced maternal age, may lower the success rates of pregnancy outcomes via infertility assistance.

The second implication of these findings is the link of any STI to HSB to infertility. Even though the analyses of any STI diagnosis on the odds of HSB cannot control for the timing of the diagnosis to the risk of HSB, it established the risk factors of sexual health behaviors and later fertility outcomes. The findings from these analyses would be particularly useful in public health campaigns geared towards increasing awareness of STI and infertility. In addition, the significant differences in the odds of HSB by parity status suggest an overall need to further examine risky-sexual health behaviors have variable outcomes for nulliparous women versus parous women.

Future Research

The primary agenda for future research stemming from these analyses is to further explore the effects of sexual health on later HSB for infertility. This would require utilizing alternative data sources that provide time specific information regarding STI diagnoses and dates of HSB for infertility. In addition, and considering that high rates of STI among women who are in their early twenties or teens, is to examine perceptions of infertility outcomes in relation to STI. For example, medical studies have indicated that the leading, preventable cause of infertility is an STI diagnosis. An important question to consider is public knowledge about this link, or more specifically, whether women in younger age groups are aware of the effects of STI on later fertility outcomes. Finally and in addition to looking at the difference in the rates of HSB by parity, is to consider the differences by gender. This dissertation did not consider gender for these analyses as the primary purpose was to identify risks by parity status, but future research will include and compare gender differences.

Contextual Effects and Health-Seeking Behaviors for Infertility

Findings

The findings from the analyses testing the effects of residing in a state with mandates that insurance cover, or offer-to-cover infertility services largely supported the null hypotheses. Or rather, the effects of residing in states with insurance mandates did not have significant effects on the rates of HSB between women at risk of primary infertility compared women at risk of secondary infertility. The only significant findings worth noting were observed in the rates of HSB for women at risk of primary infertility who lived in any state with state-level mandates. In the analyses where I make the assumption that women who have lived in the same state since 2000, have either lived in the same state since birth, or, have lived in a state with similar state-level insurance mandates or rules, the rates of HSB for women at risk of primary infertility were 76% greater than women who do not live in states with mandates. When I dropped the assumption regarding state residence since birth and/or residing in states with similar insurance rules or mandates, the results indicated that women at risk of primary infertility had rates of HSB that were 65% greater than women living in states without mandates. There were no significant effects on the rates of HSB for women at risk of secondary infertility, nor were there are significant differences in the rates of HSB by parity status. The implications of these findings and lack of significance in the differences in rates of HSB by parity status is outlined in the following section.

Implications

The overall lack of significant findings of the effects of state-level mandates on the rates of HSB for infertility can be explained by a number of possibilities. First, is the fact that limitations of the data required that I make assumptions about the state-of-residence of respondents and assumed that they had lived in the same state since 2000, and/or they had lived in a state with similar political, economic, or social policies. Or else, I only looked at HSB events occurring since 2000. These are problematic in predicting the rates of HSB for infertility because they assume individuals have not moved, it does not consider immigration effects, and they limit the sample to a select number of years. However, the limited availability of a data source to provide information for these analyses demonstrates the need to further developed and implement fertility surveys that take into consideration contextual effects like state-level mandates that also provides more detailed information regarding timing of residence and immigration.

I hypothesized that by looking at both these scenarios any significant effects on the rates of HSB could be compared between the two samples. Even though the rates of HSB by parity for either of these samples was relatively similar, or in both circumstances residing in a state with mandates increased the rates of HSB for women at risk of primary infertility, there were no significant differences among women at risk of secondary infertility and no significant differences between these types of infertility risks. This suggests that any significant findings for women at risk of primary infertility may be the result of the assumptions of state-of-residence since birth and/or, only looking at HSB since 2000.

Another possible explanation for the lack of significance in the rates of HSB by parity status is that a macro-level effect like state-mandates has little influence on individual HSB in regards to infertility. It is possible that regardless of the enabling resources or external cues present in residing in a state with mandates, the benefits of having children and overcoming any infertility complications outweighs the individual-costs of treatments. A similar explanation could be that the out-of-pocket or co-payment costs that exist even in the presence of insurance coverage for infertility services can still be very costly and therefore limit the likelihood of engaging in HSB for infertility. Therefore, living in a state with mandates for insurance would make little difference on the rates of HSB for women at risk or primary or secondary infertility.

A third a final explanation for the lack of significance may be explained by the relatively small number of states mandating coverage (only 15 states), which makes observing any significant effects on the rates of HSB for either infertility risk type unlikely.

What the findings from these analyses did indicate is that for women at risk of primary infertility, residing in a state with state-level insurance mandates increased the rates of HSB. Although this is only observed among women at risk of primary infertility, it may suggest that women in states with mandates may be more aware of coverage options for infertility due in part to other state-level characteristics that promote overall public health behaviors for conditions like infertility. However, the identification of, and controlling for, state-level effects not only goes beyond the scope of this dissertation, but would require access to additional information not available in the NSFG.

Future Research

The unique aspect of the substantive chapter testing the effects of state-level insurance mandates on the rates of HSB for infertility is that no other study has considered the differential effects that may exist by parity status. For this reason, the first step in any future research project would be to explore a data source that can provide more time-ordering information regarding state-of-residence and any infertility related HSB. A second research option would be to consider additional contextual effects on the rates of HSB. For example, exploring poverty levels, immigration flows, economic and wealth distributions, and even historical political associations of a state would provide further insight into how contextual effects have various outcomes on the rates of HSB.

Overall Conclusions

The greatest contributing factor of this dissertation to the existing research on infertility is the comparative analysis of the rates of HSB for women at risk of primary infertility versus women at risk of secondary infertility. It is important to compare the rates of HSB in the presence of select social factors, biological mechanisms, and contextual effects because the proportion of women experiencing secondary infertility is higher than the proportion of women experiencing primary infertility, and this only accounts for the number of women that report any lifetime infertility experiences (Davis, Hall, & Kaufmann, 2007). The actual number of women who are experiencing, or are at risk of secondary infertility is assumed to much higher.

In addition to the comparative analysis of this dissertation, testing the effects of select social factors, biological mechanisms, and contextual effects supports existing research on fertility and infertility by building upon existing studies linking education, employment, and relationship status to various outcomes of HSB, by highlighting innovative approaches to studying the effects of maternal age or lifetime diagnosis of STI in HSB, and by proposing that rates of HSB for infertility extend beyond the individual level and can be observed at the macro-level.

The findings from this research have overall implications for social science researchers interested in the changing social impacts on fertility trends, for medical and mental health professionals that interact and work with women and couples coping with infertility, and in public health policies in developing greater public awareness of the risks factors not only associated with infertility, but the health-seeking behaviors for infertility. More specifically, this research and the findings from the substantive research questions further promote the idea that the infertility experience can be significantly different for nulliparous women experiencing primary infertility compared to parous women experiencing secondary infertility.

REFERENCES

Abma, J.C., Martinez, G.M., Copen, C.E. (2006). Teenagers in the united states: Sexual activity, contraceptive use, and childbearing, national survey of family growth 2006-2008. *Vital Health Statistics 23*(30): 1-47.

Alberts, J.F., Sanderman, R., Gerstenbleuth, I., & Van Den Heuval, W.J.A., (1998). Sociocultural variations in help-seeking behavior for everyday symptoms and chronic diseases. *Health Policy 44*(1): 57-72.

Allison, P.D. (1982). Discrete-time methods for the analysis of event histories. *Sociological Methodology*, *13*: 61-98.

Allison, P.D. (1999). *Logistic Regression Using the SAS System*. Cary, NC: SAS Institute.

Anderson, D.J., Binder, M. & Krause, K. (2002). The motherhood wage penalty: Which mothers pay it and why? *The American Economic Review*, *92*(2).

Andersen, R.A. (1968). *A behavioral model of families' use of health services*. Chicago: University of Chicago Center for Health Administration Studies.

Andersen, R.A. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior*, *36*(1): 1-10.

Axinn, W.G., & Barber, J.S. (2001). Mass education and fertility transition. *American Sociological Review*, *66*(4): 481-505.

Bagley, C., White, H., & Golomb, B.A., (2001). Logistic regression in the medical literature: Standards for use and reporting, with particular attention to one medical domain. *Journal of Clinical Epidemiology*, *54*:979-985.

Barber, J.S. (2001). The intergenerational transmission of age at first birth among married and unmarried men and women. *Social Science Research*, *30*(2): 219-247.

Becker, M. H., ed. (1974). The health belief model and personal health behavior. *Health Education Monographs*, *2*:324–473.

Becker, G. & Nachtigall, R.D. (2000). Born to be a mother: The cultural construction of risk of infertility treatment in the u.s. *Social Science & Medicine 39*(4): 507-518.

Bell, A.V. (2009). It's way out of my league. *Gender & Society 23*(5):688.

Bitler, M., & Schmidt, L. (2006). Health disparities and infertility: Impacts of state-level insurance mandates. *Fertility and Sterility, 85*(4), 858-865.

Borrero, S., Schwarz, E.B., Creinin, M., & Ibrahim, S. (2009). The impact of race and ethnicity on receipt of family planning services in the united states. *Journal of Women's Health 18*(1): 91-96.

Bower, C., & Hansen, M. (2005). Assisted reproductive technologies and birth outcomes: Overview of recent systematic reviews. *Reproduction, Fertility and Development 17*(3): 329-333.

Bradley, E.H., McGraw, S.A., Curry, L., Buckser, A., King, K.L., Kasl, S.V., & Andersen, R. (2002). Revisiting the andersen model: The role of psychosocial factors in long-term care use. *Health Services Research 37*(5): 1221-1242.

Braveman, P. (2006). Health disparities and health equity: Concepts and measurement. *Public Health 27*: 24-39.

Budig, M.J., & England, P. (2001). The Wage penalty for mother. *American Sociological Review 66*(2), p. 204-225.

Bunting, L. & Boivin, J. (2007). Decision-making about seeking medical advice in an internet sample of women trying to get pregnant. *Human Reproduction, 22*(6): 1662-1668.

Cates, W. Jr. (2003). Preserving Fertility: An underappreciated aspect of sexual health. *Family health international*, 23-2.

Ceballo, W., Abbey, A., & Schooler, D. (2010). Perceptions of women's infertility: What do physicians see? *Fertility and Sterility, 93*(4): 1066-1073.

Centers for Disease Control and Prevention. *Sexually Transmitted Disease Surveillance 2003.* Atlanta, GA: U.S. Department of Health and Human Services.

Chandra, A., & Stephen, E. H. (2010). Infertility service use among US women: 1995 and 2002. *Fertility and Sterility, 93*(3), 725-736.

Collins, J.A., Rand, C.A., Wilson, E.H., Wrixon, W., & Casper, R.F. (1986). The better prognosis in secondary infertility is associated with a higher proportion of ovulation disorders. *Fertility and Sterility, 45*(5): 611-616.

Cutler, W.B. & Lleras-Muney, C.R. (2009). Infertility and age at first coitus: A possible relationship. *Journal of Biosocial Science, 11(*4): 425-432.

Davis III, C. H., Hall, M. N., & Kaufmann, L. (2007). What is the best way to evaluate secondary infertility? *Journal of Family Practice, 56* (7): 573-575.

Diez-Roux, A.V. (2003) "The Examination of Neighborhood Effects on Health: Conceptual and Methodological Issues Related to the Presence of Multiple Levels of Organization." In *Neighborhoods and Health* Edited by Ichiro Kawachi and Lisa F. Berkman, Oxford University Press, pp. 45-64.

Domar, A. D., Smith, K., Conboy, L., Iannone, M., & Alper, M. (2009). A prospective investigation into the reasons why insured united states patients drop out of in vitro fertilization treatment. *Fertility and Sterility,* 94(4):1457-1459.

Eisenberg, M. L., Smith, J. F., Millstein, S. G., Nachtigall, R. D., Adler, N. E., Pasch, L. A., & Katz, P. P. (2010). Predictors of not pursuing infertility treatment after an infertility diagnosis: Examination of a prospective US cohort. *Fertility and Sterility,* 94(6):2369-71.

Frost, J.J. (2008) Trends in us women's use of sexual and reproductive health care services, 1995-2002. *American Journal of Public Health 98*(19): 1814.

Hayford, S.R. (2009). The evolution of fertility expectations over the life course. *Demography 46*(4): 765–783.

Goodman, E., Huang, B., Schafer-Kalkhoff, T., & Adler, N.E. (2007). Percevied socioeconomic status: A new type of identity that influences adolescents' self-rated health. *Journal of Adolescent Health 41*(5): 479-487.

Greil, A.L. & McQuillan, J. (2004). Help-seeking patterns among subfecund women. *Journal of Reproductive and Infant Psychology 22*(4): 305-319.

Greil, A.L., Slauson-Blevins, K., & McQuillan, J. (2009). The experience of infertility: A review of recent literature. *Sociology of Health and Illness 32(*1): 140-162.

Greil, A.L., & McQuillan, J. (2010). Trying times: Medicalization, intent, and ambiguity in the definition of infertility. *Medical Anthropology Quarterly 24*(2): 137-156.

Greil, A.L., McQuillan, J., Slauson-Blevins, K. (2011). The social construction of infertility. *Sociology Compass 5*(8): 736-746.

Groves RM, Mosher WD, Lepkowski J, Kirgis NG. Planning and development of the continuous National Survey of Family Growth. National Center for Health Statistics. Vital Health Stat 1(48). 2009.

Guzzo, K.B. & Hayford, S. (2011). Fertility following an unintended first birth. *Demography, 48*(1): 493-1516.

Guzick, D.S. & Swan, S. (2006). The decline of infertility: Apparent or real? *Fertility and Sterility 86*(3): 524-526.

Janz, N.K. & Becker, M.H. (1994). The Health belief model: A decade later. *Health Education and Behavior 11*(1): 1-47.

Johnson, K.M. & Fledderjohann, J. (2012). Revisiting "her" infertility: Medicalized embodiment, self-identification and distress. *Social Science & Medicine 75*(5): 883-891.

Kalmuss, D., & Tatum, C. (2007). Patterns of men's use of sexual and reproductive health services. *Perspectives on Sexual and Reproductive Health*: 74-81.

Kelly-Weeder, S., & O'Connor, A. (2006). Modifiable risk factors for impaired fertility in women: What nurse practitioners need to know. *Journal of the American Academy of Nurse Practitioners*, *18*(6), 268-276.

Kodzi, I.A., Johnson, D.R., Casterline, J.B. (2010). Examining the predictive value of fertility preferences among ghanaian women. *Demographic Research, 22*(30): 965-984.

Lipkus IM, Iden D, Terrenoire J, Feaganes J.R. (1999). Relationships among breast cancer concern, risk perceptions, and interest in genetic testing for breast cancer susceptibility among African-American women with and without a family history of breast cancer. *Cancer EpidemiolBiomarkers Prev*; 8:533–9.

Lochner, K.A., I. Kawachi, R.T. Brennan, and S.L. Buka. (2003) Social Capital and Neighborhood Mortality Rates in Chicago." *Social Science & Medicine* 56:1797-1805.

Macaluso, M., Wright-Schnapp, T.J., Chandra, A., Johnson, R., Satterwhite, C.L., Pulver, A., Berman, S.M., Wang, R.Y., Farr, S.L., Pollack, L.A. (2010). A public health focus on infertility prevention, detection, and management. *Fertility and Sterility 93*(1): 1-16.

Macintyre, S., and Ellaway, A., (2003). “Neighborhoods and Health: An Overview.” In *Neighborhoods and Health* Edited by Ichiro Kawachi and Lisa F. Berkman, Oxford University Press, pp. 20-42.

Martinez, GM, Daniels, K, and Chandra A. (2012). Fertility of men and women aged 15-44 years in the United States: National Survey of Family Growth, 2006-2010. National health statistics reports; no. 51. Hyattsville, MN: National Center for Health Statistics. 2012.

McQuillan, J., Greil, A. L., Shreffler, K.M., Tichenor, V. (2008) The importance of motherhood among women in the contemporary united states. *Gender & Society;* 22(4): 477–496.

Maheshwari, A., Porter, M., Shetty, A., & Bhattacharya, S. (2008). Women's awareness and perceptions of delay in childbearing. *Fertility and Sterility, 90*(4), 1036-1042.

Mathews T.J., & Hamilton B.E. Delayed childbearing: More women are having their first child later in life. NCHS data brief, no 21. Hyattsville, MD: National Center for Health Statistics. 2009.

Martin, S. P. (2000). Diverging fertility among US women who delay childbearing past age 30. *Demography, 37*(4), 523-533.

Meyers, D. S., Halvorson, H., & Luckhaupt, S. (2007). Screening for chlamydial infection: An evidence update for the US preventive services task force. *Annals of Internal Medicine, 147*(2), 135.

Miller, A. R. (2010). The effects of motherhood timing on career path. *Journal of Population Economics,* 1-30.

Miller, C.W., Ford, C.A., Morris, M., Handcock, M.S., Schmitz, J.L., Hobbs, M.H., Cohen, M.S., Harris, K.M., & Udry, J.R. (2004). Prevalence of chlamydial and gonococcal infections among young adults in the united states. *Journal of American Medical Association*, *291*: 2229-2236.

Nachtigall, R.D., Castrillo, M., Shah, N., Turner, D., Harrington, J., Jackson, R. (2005). The challenge of providing infertility services to a low-income immigrant latino population. *Fertility and Sterility 92*(1): 116-123.

Pescosolido, B. (1992). Beyond rational choice: the social dynamics of how people seek help. *American Journal of Sociology*, *97*:1096-1138.

Peterson, B.D., Newton, C.R., & Rosen, K.H. (2003). Examining congruence between couples' perceived infertility related stress and its relationship to depression and marital adjustment in infertile men and women. *Family Process*, 42, 59-71.

Rindfuss, R.R., & Parnell, A.M. (1989). The varying connection between marital status and childbearing in the united states. *Population and Development Review 15*(3): 447-470.

Ross and Mirowsky. 1995. Does Employment Affect health. *Journal of Health and* Social Behavior; 36(3):230-43.

Schmidt, L. (2007). Effects of infertility insurance mandates on fertility. *Journal of Health Economics 26*(3): 431-446.

Schoen, R., Astone, M.A., Kim, Y.J., Nathanson, C.A., & Fields, J.M. (1999). Do fertility intentions affect fertility behavior? *Journal of Marriage and Family 61*(3): 790-799.

Shaw, C. (1999). A framework for the study of coping, illness behavior and outcomes. *Journal of Advanced Nursing 29*(5): 1246-1255.

Simmons, H.F. (2000). *Wanting another child: Coping with secondary infertility*. Jossey-Bass Publishers, San Francisco, CA.

Smith, J. F., Eisenberg, M. L., Millstein, S. G., Nachtigall, R. D., Sadetsky, N., Cedars, M. I., & Katz, P. P. (2011). Fertility treatments and outcomes among couples seeking fertility care: Data from a prospective fertility cohort in the united states. *Fertility and Sterility*, *95*(1):79-84.

Smith, J. F., Eisenberg, M. L., Millstein, S. G., Nachtigall, R. D., Shindel, A. W., Wing, H., Cedars, M., Pasch, L., & Katz, P. P. (2010). The use of complementary and alternative fertility treatment in couples seeking fertility care: Data from a prospective cohort in the united states. *Fertility and Sterility;* 93(7):2169-74.

Stephen, E.H., & Chandra, A. (2000). Use of infertility services in the united states, 1995. *Family Planning Perspectives 32*(2): 132-137.

Stephen, E.H. & Chandra, A. (2006). Infertility service use among us women: 1995-2002. *Fertility and Sterility 93*(3): 725-736.

Strecher, V. J., and Rosenstock, I. M. (1997). "The Health Belief Model." In *Health Behavior and Health Education: Theory, Research, and Practice,* eds. K. Glanz, F. M. Lewis, and B. K. Rimer. San Francisco: Jossey-Bass.

Tambor ES, Rimer BK, Strigo TS. (1997) Genetic testing for breast cancer susceptibility: awareness and interest among women in the general population. *American Journal of Medical Genetics;*68:43–9.

Thornton, A., & Young-DeMarco, L. (2001). Four decades of trends in attitudes toward family issues in the united states: The 1960's through the 1980's. *Journal of Marriage and Family 63*(4): 1009-1037.

Umberson, D., & Montez, J.K. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior 53*(2): 54-66.

Umberson, D., Crosnoe, R., & Reczek, C. (2010). Social relationships and health behavior across life course. *Annual Review of Sociology 1*(36): 139-157.

U.S. National Center for Education Statistics, Digest of Education Statistics, annual. Retrieved from http://www.nces.ed.gov/programs/digest/. May 29th, 2012.

Voas, D. (2003). Conflicting preferences: A reason fertility tends to be too high or too low. *Population and Development Review 29*(4): 627-646.

Waite LJ, Gallagher M. The case for marriage: Why married people are happier, healthier and better off financially. New York: Doubleday. 2000.

Wallace, L., Scoular, A., Hart, G., Reid, M., Wilson, P., & Goldberg, D. (2008). What is the excess risk of infertility in women after genital chlamydia infection? A systematic review of the evidence. *British Medical Journal, 4*(3), 171.

Weinstock H, Berman S, Cates W. (2004). Sexually transmitted diseases among american youth: Incidence and prevalence estimates. *Perspectives on Sexual and Reproductive Health* 2004; Volume 36, No. 1:6-10.

White, L., McQuillan, J., & Greil, A.L. (2006). Explaining disparities in treatment seeking: The case of infertility. *Fertility and Sterility 85*(4): 853-857.

White, L., McQuillan, J., Greil, A.L., & Johnson, D.R. (2006). Infertility: Testing a help-seeking model. *Social Science & Medicine 62*(4): 1031-1041.

Wimberly, Y.H., Kahn, J.A., Kollar, L.M., & Slap, G.B. (2003). Adolescents beliefs about infertility. *Contraception, 66*(2003): 385-391.

Wood. R.G., Goesling, B., & Avellar, S. (2007). *The effects of marriage on health: A synthesis of recent research evidence*. Princeton, NJ: Mathematica Policy Research.

Zhang, J., & Song, X. (2007). Fertility differences between married and cohabiting couples: a switching regression analysis, IZA Discussion Papers, No. 3245, http://hdl.handle.net/10419/34858. 190-180.